MESOSCALE COMPONENTS OF THE GEOSTROPHIC FLOW AND ITS TEMPORAL AND SPATIAL VARIABILITY IN THE CALIFORNIA CURRENT OFF MONTEREY BAY IN 1973-74

Richard Earl Greer

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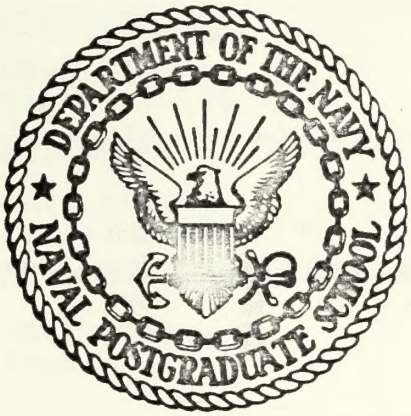

THESIS

MESOSCALE COMPONENTS OF THE GEOSTROPHIC FLOW AND ITS TEMPORAL AND SPATIAL VARIABILITY IN THE CALIFORNIA CURRENT OFF MONTEREY BAY IN 1973-74

by

Richard Earl Greer

September 1975

Thesis Advisor: J. B. Wickham

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T170096

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
Mesoscale Components of the Geostrophic Flow and Its Temporal and Spatial Variability in the California Current off Monterey Bay in 1973-74

5. TYPE OF REPORT & PERIOD COVERED
Master's Thesis; September 1975

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
Richard Earl Greer

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Naval Postgraduate School
Monterey, California 93940

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
Naval Postgraduate School
Monterey, California 93940

12. REPORT DATE
September 1975

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)
Naval Postgraduate School
Monterey, California 93940

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Geostrophic current
California countercurrent
California current system
Eastern boundary currents
Davidson current
Oceanographic surveys
Geostrophic salt transport

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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Seasonal variations of the geostrophic flow and salt transport were congruent with Skogsberg's [1936] annual cycle composed of three distinct oceanographic seasons.

The flow and structure in the area are complex with flow elements less than 10 km in width. The data suggest that observations on a sampling grid length less than 10 km transverse to the current flow, and extensive independent current measurements are required to describe adequately the small-scale features of the flow, structure and its time variations.

Mesoscale Components of the Geostrophic Flow and its Temporal and Spatial Variability in the California Current off Monterey Bay in 1973-74

by

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Lieutenant, United States Navy
B.A., Frostburg State College, 1967

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OCEANOGRAPHY

from the

NAVAL POSTGRADUATE SCHOOL

September 1975

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TABLE OF CONTENTS

I. INTRODUCTION----------12

II. THE DATA----------14

A. AREA OF INVESTIGATION AND DATA COLLECTION----------14

B. PROCEDURE----------18

C. INSTRUMENTATION----------19

III. DATA PROCESSING----------21

A. PROCEDURE----------21

B. DATA PREPARATION----------21

C. DIGITIZATION----------22

D. CALIBRATION AND STANDARDIZATION----------24

E. AUTOMATIC DATA PROCESSING PROGRAMS----------25

F. GEOSTROPHIC CURRENT AND DYNAMIC HEIGHT CALCULATIONS----------26

G. GEOSTROPHIC SALT TRANSPORT CALCULATIONS----------27

IV. DISCUSSION AND RESULTS----------29

A. THE GEOSTROPHIC CURRENT AND ITS LEVEL OF NO MOTION----------29

B. PATTERNS OF CURRENT FLOW AND THEIR STRUCTURE WITH DEPTH----------43

C. TEMPORAL VARIATION OF THE GEOSTROPHIC FLOW----------53

D. GEOSTROPHIC CURRENTS AND SALT TRANSPORT----------66

V. SUMMARY AND CONCLUSIONS----------86

A. GENERAL----------86

B. PATTERNS OF CURRENT FLOW AND THEIR STRUCTURE WITH DEPTH----------86

C. TEMPORAL VARIATION OF THE GEOSTROPHIC FLOW----------87

D. GEOSTROPHIC CURRENT AND SALT TRANSPORT----------88

APPENDIX A: COMPUTER PROGRAM DIGISTD----------89

APPENDIX B: COMPUTER PROGRAM DIGIXBT----------132

APPENDIX C: COMPUTER PROGRAM MODIFIED HYDRO----------165

BIBLIOGRAPHY----------176

INITIAL DISTRIBUTION LIST----------178

LIST OF TABLES

I. Latitude and Longitude of Stations (August 1973 - August 1974)----------17

II. Level of No Motion Analysis (October 1973 - Stations 317-307)----------32

III. Level of No Motion Analysis (October 1973 - Stations 307-303)----------33

IV. Level of No Motion Analysis (November 1973 - Stations 317-307)----------34

V. Level of No Motion Analysis (November 1973 - Stations 307-303)----------35

VI. Level of No Motion Analysis (December 1973 - Stations 307-303)----------36

VII. Level of No Motion Analysis (January 1974 - Stations 317-307)----------37

VIII. Level of No Motion Analysis (January 1974 - Stations 307-303)----------38

IX. Level of No Motion Analysis (August 1974 - Stations 317-307)----------39

X. Level of No Motion Analysis (August 1974 - Stations 307-303)----------40

LIST OF FIGURES

1. Major Geographical and Topographical Features of the Investigation Area----------15

2. The Location of Station Positions within the Investigation Area----------16

3. Dynamic Height Contours at the Surface during August 1973----------44

4. Dynamic Height Contours of the 50 db Surface during August 1973----------45

5. Dynamic Height Contours of the 100 db Surface during August 1973----------46

6. Dynamic Height Contours of the 200 db Surface during August 1973----------47

7. Dynamic Height Contours of the 300 db Surface during August 1973----------48

8. Dynamic Height Contours of the 375 db Surface during August 1973----------49

9. Dynamic Height Contours of the 425 db Surface during August 1973----------50

10. General Pattern of Geostrophic Current Flow during August 1973----------52

11. Temporal Variation of Dynamic Height Contours at the Surface for August 1973 through January 1974---54

12. Temporal Variation of Dynamic Height Contours of the 50 db Surface for August 1973 through January 1974----------55

13. Temporal Variation of Dynamic Height Contours of the 100 db Surface for August 1973 through January 1974----------56

14. Temporal Variation of Dynamic Height Contours of the 200 db Surface for August 1973 through January 1974----------57

15. Temporal Variation of Dynamic Height Contours of the 300 db Surface for August 1973 through January 1974----------58

16. Temporal Variation of Dynamic Height Contours of the 375 db Surface for August 1973 through January 1974---------- 59

17. Temporal Variation of Dynamic Height Contours at the Surface for January 1974 through August 1974--- 61

18. Temporal Variation of Dynamic Height Contours of the 50 db Surface for January 1974 through August 1974---------- 62

19. Temporal Variation of Dynamic Height Contours of the 100 db Surface for January 1974 through August 1974---------- 63

20. Temporal Variation of Dynamic Height Contours of the 200 db Surface for January 1974 through August 1974---------- 64

21. Temporal Variation of Dynamic Height Contours of the 300 db Surface for January 1974 through August 1974---------- 65

22. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 111-102 during August 1973------ 67

23. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 214-202 during August 1973------ 68

24. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 315-302 during August 1973------ 69

25. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 305-302 during September 1973--- 70

26. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during October 1973----- 71

27. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during November 1973---- 72

28. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during December 1973---- 73

29. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during January 1974----- 74

30. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during February 1974---------- 75

31. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during June 1974---------- 76

32. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during July 1974----------77

33. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during August 1974------78

ACKNOWLEDGEMENT

The author would like to thank several individuals and organizations whose assistance made the overall success of this thesis research possible:

First, my special thanks to Professor Jacob B. Wickham of the Naval Postgraduate School, Monterey, California who provided the raw data, guidance, and advice which facilitated the solution of problems during the conduct of the thesis research.

Lieutenant Commander C. E. Workman, U.S.N., of the Oceanography Section of the Fleet Numerical Weather Center, Monterey, California for his personal assistance which permitted us to utilize the Center's Calma Digitizers.

Professor R. G. Paquette, Oceanography Department, and Ms. Sharon Raney of the Naval Postgraduate School for providing invaluable assistance in computer programming.

Lieutenants Richard E. Blumberg and John G. Hughes, U.S.N., for their efforts in the joint data work-up during the initial stages of the thesis.

Finally, my wife, Pat, for providing encouragement, patience, and her expertise in typing technical reports which allowed me to complete this task on time.

I. INTRODUCTION

Eastern boundary currents, in particular, the California Current, have held the interest of investigators for many years. This is due largely to an avid interest in coastal upwelling, and its important implications on commercial fisheries and related economic enterprises. However, there are other important aspects. Of interest is the poleward countercurrent found close to the prevailing equatorward surface currents. The countercurrent is usually narrower, and found shoreward of the equatorward flow. During the winter months (November through February), and in the absence of prevailing north-northwesterly winds, the poleward countercurrent extends to the surface and is known as the Davidson Current north of Pt. Conception. With the onset of north-northwesterly winds in the spring, upwelling begins to occur along the California coast, and the poleward countercurrent disappears above 200 m. Where the flow is submerged, the countercurrent has been termed an "undercurrent." Of importance is that the poleward countercurrent continues throughout the year at speeds approximately 30 cm/sec or less. Consequently, the water off the California coast tends to have some of the high temperature and salinity characteristics of the low-latitude or "southern waters" (in the Northern Hemisphere). Accordingly, with the poleward transport of warm and salty southern waters, the resulting flow and structure along the California coast will necessarily

be highly complex. In fact, spatially dense observations in consecutive years in a region within 50 km of the continental shelf show a complex structure of southern water undergoing dilution by mixing as it flows northward [Wickham, 1975].

At present, there are many questions still outstanding about the countercurrent, and the resulting highly complex current regime off the California coast. It is the intent of this author to provide answers to a few of them. Specifically, using a data base constructed from spatially dense STD observations off Monterey Bay in 1973-74, an attempt will be made to examine the following,

(1) The patterns of current flow, and their structure with depth,

(2) The temporal variation of the geostrophic flow,

(3) Mesoscale components of the geostrophic current and salt transport.

Additionally, attention will be given to the influence of bottom topography on the direction of flow inside the 1,000 fathom curve, the dependence of geostrophic current on the choice of reference level, and the use of geostrophy to depict small-scale features of the complex flow.

II. THE DATA

A. AREA OF INVESTIGATION AND DATA COLLECTION

The area of investigation is shown in figure 1, in which the major features of the bottom topography are depicted. The major topographical features of the area include Monterey Bay and the Monterey Canyon. The area of investigation lies within the rectangular parallelepiped located just west of the continental shelf off Monterey, California. It extends from the surface to a maximum depth of 725 meters and is bounded by the coordinates, 36^{o} 20'N, 36^{o} 50'N, 122^{o} 00'W, and 123^{o} 00'W.

The data were obtained from thirteen cruises aboard the Acania, the oceanographic vessel of the U.S. Naval Postgraduate School, during the months August 1973 through August 1974. A cruise was conducted once each month during various days of the thirteen-month period. On each cruise observations were made along a horizontal grid much finer than traditionally used in oceanographic surveys to permit increased horizontal definition. Specifically, stations were located along four constant latitude lines normal to the coast at a maximum spacing of 5.6 km between stations; at least one line of stations being occupied on a cruise. Station positions are shown in figure 2, and listed in table I.

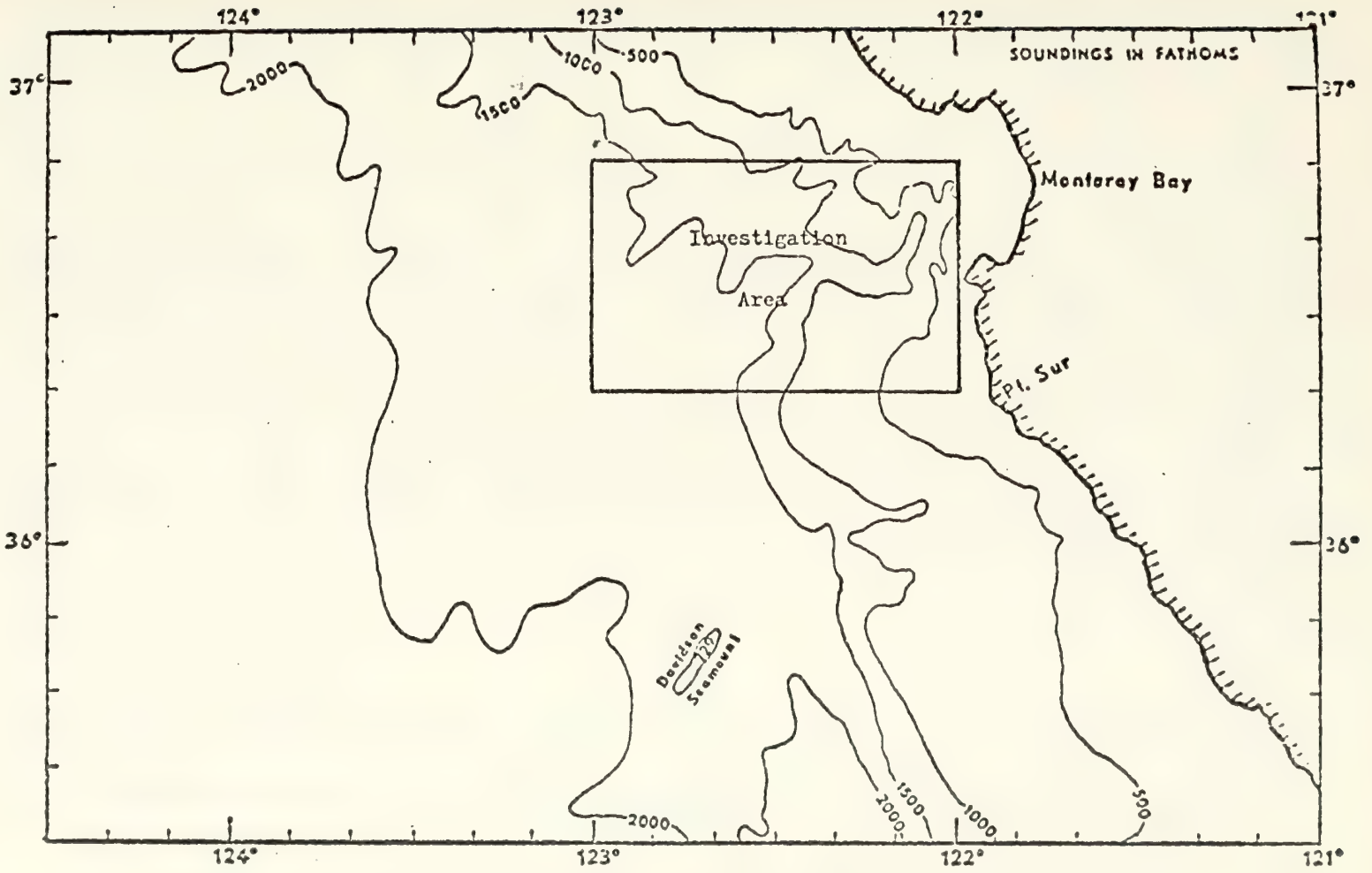


Fig. 1. Major Geographical and Topographical Features of the Investigation area.

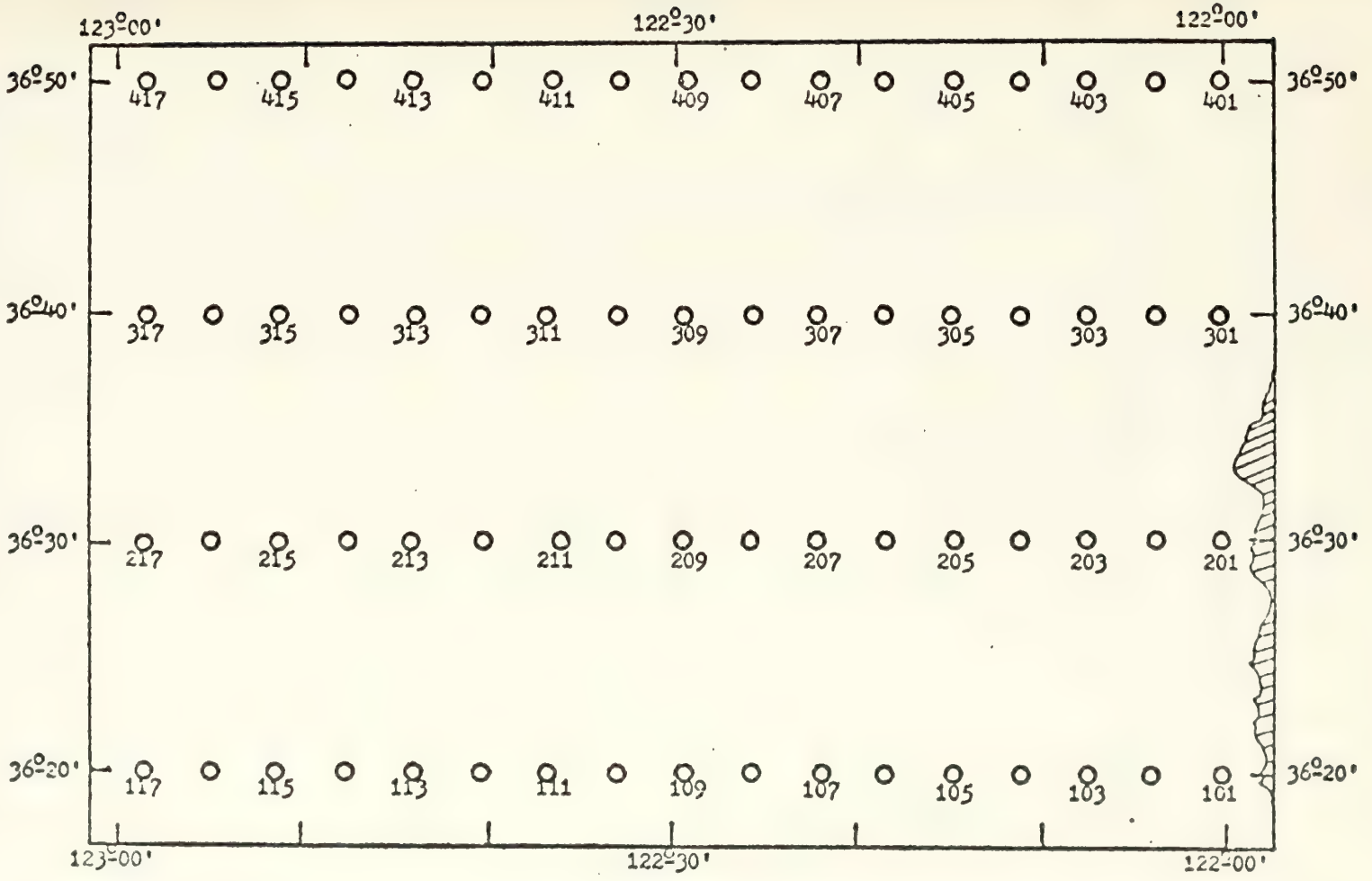


Fig. 2. The Location of Station Positions within the Investigation Area.

TABLE I

LATITUDE AND LONGITUDE OF STATIONS
(August 1973 - August 1974)

Station Numbers	Latitude (North)	Longitude (West)
101	36° 20.0'	122° 00.0'
102	36° 20.0'	122° 03.6'
103	36° 20.0'	122° 07.3'
104	36° 20.0'	122° 10.9'
105	36° 20.0'	122° 14.5'
106	36° 20.0'	122° 18.2'
107	36° 20.0'	122° 21.8'
108	36° 20.0'	122° 25.4'
109	36° 20.0'	122° 29.1'
110	36° 20.0'	122° 32.7'
111	36° 20.0'	122° 36.4'
112	36° 20.0'	122° 40.0'
113	36° 20.0'	122° 43.6'
114	36° 20.0'	122° 47.3'
115	36° 20.0'	122° 50.9'
116	36° 20.0'	122° 54.5'
117	36° 20.0'	122° 58.2'
201 - 217	36° 30.0'	*
301 - 317	36° 40.0'	*
401 - 417	36° 50.0'	*

* Station with same last two digits as 100 series have the same longitude with the exception of station 211, which is located at 36° 30.0'N, and 122° 35.8'W.

B. PROCEDURE

The thirteen cruises aboard the Acania during the period August 1973 through August 1974 provided the data base for this study. Original cruise plans called for all thirteen cruises to utilize the Bissett-Berman continuous profiling STD as the primary observational tool in conjunction with reversing thermometers and Nansen samples, which would provide independent measurements for comparison of temperature and salinity and standardization of the STD. Additionally, expendable bathythermograph (XBT) and surface (bucket) temperatures would provide data for further comparisons. However, due to STD malfunction or in the interest of time-saving the original cruise plans were modified. Specifically, seven cruises utilized the STD as their primary observational tool, while five of the remaining six cruises utilized the XBT. The remaining cruise conducted during April 1974 was terminated early due to equipment malfunction and poor weather conditions.

On STD cruises, a Bissett-Berman continuous profiling instrument (STD) sensed the vertical distributions of temperature and salinity. To obtain vertical definition of approximately two meters, the STD was lowered at a rate of 30 meters per minute. Profiles were recorded for both descent and ascent of the STD so that, during the digitizing of analog traces, spurious spikes in the salinity record could be recognized and eliminated by manual trace smoothing techniques described in the section on data processing. The spikes are known to be caused by a mismatch of time constants between the temperature and conductivity sensors.

On other cruises, expendable bathythermograph (XBT) soundings were utilized to delineate the vertical distributions of temperature. To supplement the XBT temperature data, three Nansen casts were conducted per station line at the eastern, western and mid-sectors of the investigation area. Water samples were taken at the following nine depths: 0, 20, 50, 100, 200, 300, 400, 500 and 750 meters. Obviously, the spacing between hydrocast stations and the interval between water sampling depths did not permit the vertical and horizontal definition of salinity achieved on cruises where the STD was primary. However, hydrocast stations added importantly to the information obtained in the study area.

On all thirteen cruises, independent measurements of temperature and salinity were made, respectively, with reversing thermometers and with laboratory conductivity analysis of sea water samples taken from Nansen bottles. Additionally, surface (bucket) and thermograph temperatures were recorded at each station. These independent measurements and their use are discussed later in the section on data processing.

C. INSTRUMENTATION

The STD instrument used was the Bissett-Berman STD Model 9006. Manufacturer's specifications claim an accuracy of $\pm 0.02^{o}C$ and ± 0.02 ppt for temperature and salinity, respectively.

Data were recorded on a continuous analog chart recorder during both descent and ascent of the STD. Data obtained during ascent of the STD were used only to smooth the salinity

record and eliminate false salinity spikes. Although data taken from the up and down casts were in good general agreement, only down trace data were digitized and used for analyses. See Data Processing section for further details.

III. DATA PROCESSING

A. PROCEDURE

Analog strip chart data obtained from the thirteen cruises conducted during August 1973 through August 1974 were manually smoothed, digitized and recorded on a Calma Digitizer 7-track tape recorder. The digitized salinity, temperature and depth data were then read, converted and processed by means of program "DIGISTD" developed for use with the IBM 360 computer. The temperature, salinity and depth data along with calculated values of sound velocity and sigma-t were then grouped according to chronological order and station and written onto 9-track tape. Additionally, salinity and temperature data for every 2.5 meters of depth were output to punched cards for use with a modified version of the HYDRO program to make dynamic height and geostrophic current calculations. These geostrophic current velocities were then used in computations of geostrophic salt transport.

B. DATA PREPARATION

Prior to digitization of the analog data, false salinity spikes caused by the mismatch of time constants between the sensors for temperature and conductivity used to calculate salinity had to be recognized and eliminated. Recognition of spurious salinity spikes was accomplished by comparison of the trace records obtained from the descent and ascent of the STD. Specifically, salinity spikes which were of opposite

sign between the up and down traces of a particular station were assumed to be spurious, and were eliminated. This elimination was accomplished by manually smoothing through the spike along the general trend of the salinity record. This technique involves some qualitative judgment or artistic license; however, salinity trace smoothing was done consistently and appears to represent quite well the true structure. This is borne out by the fact that within the accuracy limitations of the other steps in the digitization process, the densities (sigma-t values) computed from the temperature and smoothed salinity data increased monotonically with increasing depth with few exceptions. The paucity of apparent instabilities, i.e., regions of

$$\frac{d\sigma_t}{dz} < 0 ,$$

and the uniformity of the trace-smoothing process tends to justify the data preparation process.

C. DIGITIZATION

Digitization of the cruise data was a portion of the joint (Greer, Blumberg and Hughes) data work-up. Both the STD and XBT strip chart data obtained from the thirteen cruises conducted during August 1973 through August 1974 were digitized on two Calma Digitizers owned by the Fleet Numerical Weather Center, Monterey, California. The Calma Company Model 480 Digitizer reduces analog graphical data to digital form for computer processing and analysis.

To digitize analog graphical data directly on computer compatible 7-track magnetic tape, the operator selects tracer mode and manually traces the graphical data with a moveable stylus/carriage assembly. The movements of the stylus in the X and Y directions are transmitted to magnetic encoders, which convert the stylus movements in 0.01 inches to digital signals. These signals are processed and formatted for output to 7-track computer magnetic tape. The digital data are recorded on tape at a bit density of 556 BPI.

In addition to the digitization tracer mode, the Calma Digitizer has a manual keyboard entry mode for identification of data on the tape, entering inter-record gaps, record errors, and delete records. The keyboard mode was used in conjunction with each digitized trace segment to identify the particular data station number, month and year, temperature, salinity and depth scales, last trace segment, and whether it was a temperature or salinity trace. Consequently, the output tape was constructed so that every other record was a 13-character keyboard mode entry which identified the following data trace record.

The Calma Digitizer variable interval programmer monitors the output recorder and generates signals every 0.01 inches of stylus movement in the X and Y directions if the stylus is moved at a rate less than 125 inches per minute. At higher rates, the data signals are recorded at 0.02 inches of stylus travel. All cruise data were digitized at 0.01 inches of stylus movement.

The STD data were digitized in segments since the temperature and salinity traces were not continuous due to scale changes in salinity, temperature and depth during collection of the data. Typically, an STD trace consisted of four temperature and two salinity segments. In contrast, the XBT traces consisted of one continuous segment. Consequently, digitizing an STD trace took approximately five times as long as an XBT trace.

D. CALIBRATION AND STANDARDIZATION

On all thirteen cruises, independent measurements of temperature and salinity were made, respectively, with reversing thermometers and with laboratory conductivity analysis of sea water samples taken from Nansen bottles. These independent measurements were used for field calibration of the STD, and to provide standardization of the STD and XBT data permitting qualitative discussion and comparison of the seasonal variation over the thirteen-month period.

In standardizing both the STD and XBT data, the Nansen temperatures and salinities were considered to be the actual or correct temperature and salinity values. Upon examination and comparison of the STD data with the Nansen data, the STD was found to read high in temperature by $0.08^{o}C$ for all primary STD data collection months, and low in salinity by 0.04 ppt for data months November 1973 through January 1974, and August 1974. Consequently, the STD temperatures and salinities were decreased and increased respectively to align the STD data with the independent Nansen data.

Standardization of the XBT data was accomplished in a similar manner. However, independent Nansen data were not available, in all cases, for corresponding XBT data stations. Therefore, when corresponding Nansen data were not available, the XBT was corrected to the already standardized STD. Adjustment of the XBT to the standardized STD data made qualitative discussion and comparison of the seasonal variation over the thirteen-month period possible. The corrections were determined by a best-fit curve developed by a computer routine fitting the XBT data with Nansen data when available or with the standardized STD data. Generally, temperature corrections varied from +0.13°C to -0.37°C for data months August 1973 through August 1974.

E. AUTOMATIC DATA PROCESSING PROGRAMS

Two computer programs, DIGISTD and DIGIXBT, were utilized to read, convert, and process the digitized salinity, temperature and depth data from the 7-track tapes produced on the Calma Digitizers. Both DIGISTD and DIGIXBT are extensively modified versions of an original program MIZ2 by R. G. Paquette. Indicative of their names, DIGISTD processes STD data and DIGIXBT processes expendable bathythermograph data. See appendices A and B for program documentation and listing.

DIGISTD and DIGIXBT convert and store STD and XBT data, respectively, every 0.01 inches of depth on the scale of the digitizer for output to printer, punched card or 9-track tape. Additionally, DIGISTD computes both sound velocity and sigma-t for each set of primary data.

During the data processing phase, all three output media, printer, punched card and 9-track tape, were utilized. Specifically, STD data were output every 0.08 inches of depth (approximately 2.5 meters) to punched card for later direct input into the HYDRO program to compute dynamic heights and geostrophic velocities. Although the number of output data cards produced by punching data points every 2.5 meters appeared to be unwieldy at the outset, this procedure proved manageable, and avoided needless programming problems in getting the correct data off the tape, and in the right order for input to program HYDRO.

F. GEOSTROPHIC CURRENT AND DYNAMIC HEIGHT CALCULATIONS

Geostrophic currents were computed by the dynamic method utilizing a modified version of the computer program, HYDRO, developed for use with the IBM 360 computer by the U.S. Naval Postgraduate School Department of Oceanography. A modified version of the HYDRO program is presented in appendix C. The two basic program modifications are: (1) an increased capability to process temperature and salinity data on a finer vertical scale (approximately 2.5 meters) than traditionally used in oceanographic surveys, and (2) an output card punching routine which produces composite data cards, each containing depth, temperature, salinity, geostrophic velocity, dynamic heights and mass transport values. The composite data cards are useful as input for plotting and contouring computer programs. Specifically, contour and plotting routine, CONTUR, was utilized to display graphically contours of dynamic heights, geostrophic

velocities and geostrophic salt transport on the off-line Calcomp plotter.

Dynamic heights and geostrophic speeds were calculated every ten meters of depth for the first 300 meters of depth, and less frequently for the remaining 200 meters. The ten meter interval proved extremely effective in depicting the complex velocity structure. However, the resulting detailed description of the structure and flow indicated that a larger data interval (every 20 meters for the first 300 meters, and every 50 meters thereafter) would have been sufficient to represent the fine scale structure. Consequently, data in the vertical need not be processed on an interval less than 20 meters. For the investigator processing STD data via cards, this will significantly reduce the number of data cards required for input into HYDRO.

G. GEOSTROPHIC SALT TRANSPORT CALCULATIONS

Geostrophic transport of salt or the salt flux per unit time-area is readily calculated as the product of density, average salinity and geostrophic velocity. Algebraically, the geostrophic salt transport, F_s, may be written as:

$$F_s = (V_{gs})(S)(\rho_{s,t,o}) \qquad (1)$$

where

V_{gs} = geostrophic velocity (cm/sec)

S = average salinity (ppt)

$\rho_{s,t,o}$ = density (gm/cm^3)

F_s = geostrophic transport of salt ($gm/sec\text{-}cm^2$)

The total salt transport, T_s, or salt flux per unit time in area length, ΔX, in a layer of thickness, ΔZ, would be given by,

$$T_S = \int_{\Delta X} \int_{\Delta Z} F_s \, dz \, dx \qquad (2)$$

Values of geostrophic transport of salt were calculated for every 20 meters of depth for the first 300 meters beginning at ten meters, and less frequently from 300 to 500 meters. To obtain an average salinity value corresponding to the geostrophic velocity computed between adjacent stations, an arithmetic mean was used. Specifically, to obtain an average salinity value at ten meters' depth between stations A and B, an arithmetic mean was computed using the surface, 10 and 20 meter salinity values at both adjacent stations A and B. This procedure was used to obtain a representative salinity value between adjacent stations, and to avoid using anomalous values of salinity in the salt transport calculations. The other variable, density, was considered constant over the entire vertical column due to its insignificant effect on the computations. A constant value of 1.026 gm/cm^3 was used for density.

IV. DISCUSSION AND RESULTS

A. THE GEOSTROPHIC CURRENT AND ITS LEVEL OF NO MOTION

The computation of geostrophic currents by the dynamic method has been discussed extensively in physical oceanography texts such as Neumann and Pierson [1966], and Stommel [1965]. The computation scheme is based on an equation derived by Sandström and Helland-Hansen [1903] from Bjerknes Circulation Theorem [1900]. In Oceanography, the equation is widely referred to as the Helland-Hansen equation, and has been extensively used to compute the relative field of currents from the observed field of mass. The equation may be written in terms of the horizontal pressure gradient of the geopotential between two levels P_1 and P_2,

$$V_2 - V_1 = \frac{\int_{P_1}^{P_2} \alpha_A \, dP - \int_{P_1}^{P_2} \alpha_B \, dP}{f \, \Delta X} \qquad (3)$$

where

$f = 2\omega \mathrm{SIN}\phi$, the coriolis parameter (1/sec)

ω = the angular velocity of the earth (radians/sec)

ϕ = the geographic latitude (degrees)

ΔX = the distance between stations A and B (kilometers)

α = specific volume (cm^3/gm); subscripts A and B refer to stations A and B

P = pressure (decibars)

$V_2 - V_1$ = the component of horizontal velocity normal to ΔX at P_1 relative to that at P_2 (cm/sec)

Equation (3) may be evaluated to obtain the mean geostrophic flow normal to a horizontal line joining stations A and B. This method permits only the computation of relative velocities. In order to arrive at the absolute currents, either the absolute pressure field or the absolute velocity must be known at least at one level between adjacent stations [Neumann and Pierson, 1966]. The absolute velocity may be found by determining the level or depth at which the currents become zero. In Oceanography, this depth is referred to as the 'level of no motion'. Some methods for estimating this reference level are given in the textbook, The Oceans, by Sverdrup, Johnson and Fleming, 1942, pp. 456-457. However, it is common practice to assume a depth where the currents become zero or to infer it from considerations of continuity.

An obvious way would be to determine the 'level of no motion' by direct measurements. However, this method has limitations due to the presence of other disturbances such as tidal currents, and the difficulty in sensing accurately relatively weak currents. Consequently, several investigators have attempted to corroborate their geostrophic current values, and indirectly their choice of reference level, by independent measurements of the current field by use of parachute drogues. For example, in a study of the California Current System off Baja, California, Reid, Swartzlose and Brown [1963] showed that geostrophic currents computed with respect to a 500 db reference level compared favorably with surface currents independently measured by drogues. On the other hand, other

investigators have found that they agree only roughly. Wickham [1975] in "Observations of the California Countercurrent" found that the local geostrophic current speeds agreed only roughly with the parachute drogue speeds. There are good reasons to expect differences between the actual flow and the results of geostrophy. First, there are obvious non-geostrophic components shown in the drogue speed values; and second, in the investigation area especially near the Monterey Canyon there are large internal waves known to exist, and finally, deformations of the reference isobaric surface (500 db) also must contribute to the difference between actual flow and the results of geostrophy [Wickham, 1975].

For this study, a reference level of 500 db was chosen as the 'level of no motion'. This choice was precipitated by the vertical extent (525 m) of the data in most cases and the success of earlier studies which found the 500 db reference to be suitable for the area.

During the months, January and August 1974, and October through December 1973, STD data were obtained to approximately 735 meters of depth at several stations. These deep station observations permitted geostrophic current calculations using the 700 db, 600 db and the 500 db levels as the reference level of no motion. Tables II through X are the resultant geostrophic currents from the surface to 475 meters relative to the three reference levels, and the velocity shears between the reference levels. To clarify the results contained in Tables II through X, the following variables are defined,

TABLE II

LEVEL OF NO MOTION ANALYSIS

OCTOBER 1973 - STATIONS 317-307

DEPTH (METERS)	VELOCITIES (CM./SEC.)					
Z	VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	1.87	2.56	2.95	-1.08	-0.69	-0.39
10.	1.07	1.76	2.15	-1.08	-0.69	-0.39
20.	-0.20	0.48	0.87	-1.07	-0.68	-0.39
30.	-1.39	-0.71	-0.32	-1.07	-0.68	-0.39
40.	-2.17	-1.49	-1.10	-1.07	-0.68	-0.39
50.	-2.98	-2.29	-1.90	-1.08	-0.69	-0.39
60.	-3.74	-3.06	-2.67	-1.07	-0.68	-0.39
70.	-4.33	-3.64	-3.25	-1.08	-0.69	-0.39
80.	-4.87	-4.18	-3.79	-1.08	-0.69	-0.39
90.	-5.23	-4.54	-4.15	-1.08	-0.69	-0.39
100.	-5.44	-4.75	-4.36	-1.08	-0.69	-0.39
110.	-5.55	-4.86	-4.47	-1.08	-0.69	-0.39
120.	-5.61	-4.93	-4.54	-1.07	-0.68	-0.39
130.	-5.67	-4.98	-4.59	-1.08	-0.69	-0.39
140.	-5.63	-4.95	-4.56	-1.07	-0.68	-0.39
150.	-5.56	-4.88	-4.49	-1.07	-0.68	-0.39
160.	-5.46	-4.78	-4.39	-1.07	-0.68	-0.39
170.	-5.35	-4.67	-4.28	-1.07	-0.68	-0.39
180.	-5.22	-4.54	-4.15	-1.07	-0.68	-0.39
190.	-5.05	-4.36	-3.97	-1.08	-0.69	-0.39
200.	-4.83	-4.14	-3.75	-1.08	-0.69	-0.39
210.	-4.58	-3.90	-3.51	-1.07	-0.68	-0.39
220.	-4.32	-3.64	-3.25	-1.07	-0.68	-0.39
230.	-4.06	-3.38	-2.99	-1.07	-0.68	-0.39
240.	-3.81	-3.12	-2.73	-1.08	-0.69	-0.39
250.	-3.56	-2.87	-2.48	-1.08	-0.69	-0.39
260.	-3.32	-2.64	-2.25	-1.07	-0.68	-0.39
270.	-3.10	-2.42	-2.03	-1.07	-0.68	-0.39
280.	-2.90	-2.22	-1.83	-1.07	-0.68	-0.39
290.	-2.71	-2.02	-1.63	-1.08	-0.69	-0.39
300.	-2.53	-1.84	-1.45	-1.08	-0.69	-0.39
340.	-1.96	-1.27	-0.88	-1.08	-0.69	-0.39
375.	-1.50	-0.82	-0.43	-1.07	-0.68	-0.39
425.	-1.23	-0.54	-0.15	-1.08	-0.69	-0.39
475.	-1.15	-0.46	-0.07	-1.08	-0.69	-0.39

TABLE III

LEVEL OF NO MOTION ANALYSIS

OCTOBER 1973 - STATIONS 307-303

DEPTH (METERS) Z	VELOCITIES (CM./SEC.) VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	0.75	0.95	1.62	-0.87	-0.20	-0.67
10.	-0.20	0.0	0.67	-0.87	-0.20	-0.67
20.	-0.29	-0.09	0.58	-0.87	-0.20	-0.67
30.	-0.73	-0.53	0.14	-0.87	-0.20	-0.67
40.	-1.47	-1.27	-0.60	-0.87	-0.20	-0.67
50.	-2.02	-1.82	-1.15	-0.87	-0.20	-0.67
60.	-2.28	-2.08	-1.41	-0.87	-0.20	-0.67
70.	-2.53	-2.33	-1.66	-0.87	-0.20	-0.67
80.	-2.60	-2.40	-1.73	-0.87	-0.20	-0.67
90.	-2.70	-2.49	-1.82	-0.88	-0.21	-0.67
100.	-2.75	-2.55	-1.88	-0.87	-0.20	-0.67
110.	-2.72	-2.51	-1.84	-0.88	-0.21	-0.67
120.	-2.62	-2.41	-1.74	-0.88	-0.21	-0.67
130.	-2.51	-2.30	-1.63	-0.88	-0.21	-0.67
140.	-2.38	-2.18	-1.51	-0.87	-0.20	-0.67
150.	-2.26	-2.06	-1.39	-0.87	-0.20	-0.67
160.	-2.16	-1.96	-1.29	-0.87	-0.20	-0.67
170.	-2.05	-1.85	-1.18	-0.87	-0.20	-0.67
180.	-1.88	-1.68	-1.01	-0.87	-0.20	-0.67
190.	-1.77	-1.57	-0.90	-0.87	-0.20	-0.67
200.	-1.71	-1.51	-0.84	-0.87	-0.20	-0.67
210.	-1.72	-1.52	-0.85	-0.87	-0.20	-0.67
220.	-1.77	-1.57	-0.90	-0.87	-0.20	-0.67
230.	-1.86	-1.65	-0.98	-0.88	-0.21	-0.67
240.	-1.94	-1.74	-1.07	-0.87	-0.20	-0.67
250.	-1.96	-1.76	-1.09	-0.87	-0.20	-0.67
260.	-1.96	-1.75	-1.08	-0.88	-0.21	-0.67
270.	-1.92	-1.72	-1.05	-0.87	-0.20	-0.67
280.	-1.89	-1.69	-1.02	-0.87	-0.20	-0.67
290.	-1.85	-1.65	-0.98	-0.87	-0.20	-0.67
300.	-1.85	-1.65	-0.98	-0.87	-0.20	-0.67
340.	-2.35	-2.14	-1.47	-0.88	-0.21	-0.67
375.	-2.54	-2.34	-1.67	-0.87	-0.20	-0.67
425.	-2.12	-1.92	-1.25	-0.87	-0.20	-0.67
475.	-1.28	-1.07	-0.40	-0.88	-0.21	-0.67

TABLE IV

LEVEL OF NO MOTION ANALYSIS

NOVEMBER 1973 - STATIONS 317-307

DEPTH - - - - - - - - - - - - VELOCITIES - - - - - - - - - - - -

(METERS) - - - - - - - - - - - - - - (CM./SEC.) - - - - - - - - - - - -

Z	VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	-9.86	-9.54	-8.44	-1.42	-0.32	-1.10
10.	-10.22	-9.89	-8.79	-1.43	-0.33	-1.10
20.	-10.58	-10.25	-9.15	-1.43	-0.33	-1.10
30.	-10.79	-10.46	-9.36	-1.43	-0.33	-1.10
40.	-10.60	-10.28	-9.18	-1.42	-0.32	-1.10
50.	-10.69	-10.36	-9.26	-1.43	-0.33	-1.10
60.	-10.80	-10.47	-9.37	-1.43	-0.33	-1.10
70.	-10.74	-10.41	-9.31	-1.43	-0.33	-1.10
80.	-10.49	-10.16	-9.06	-1.43	-0.33	-1.10
90.	-10.23	-9.90	-8.80	-1.43	-0.33	-1.10
100.	-10.00	-9.68	-8.57	-1.43	-0.32	-1.11
110.	-9.79	-9.47	-8.37	-1.42	-0.32	-1.10
120.	-9.64	-9.31	-8.21	-1.43	-0.33	-1.10
130.	-9.45	-9.12	-8.02	-1.43	-0.33	-1.10
140.	-9.25	-8.92	-7.82	-1.43	-0.33	-1.10
150.	-9.06	-8.74	-7.64	-1.42	-0.32	-1.10
160.	-8.89	-8.57	-7.47	-1.42	-0.32	-1.10
170.	-8.73	-8.40	-7.30	-1.43	-0.33	-1.10
180.	-8.54	-8.21	-7.11	-1.43	-0.33	-1.10
190.	-8.32	-8.00	-6.90	-1.42	-0.32	-1.10
200.	-8.13	-7.81	-6.70	-1.43	-0.32	-1.11
210.	-7.91	-7.59	-6.48	-1.43	-0.32	-1.11
220.	-7.67	-7.35	-6.25	-1.42	-0.32	-1.10
230.	-7.43	-7.11	-6.00	-1.43	-0.32	-1.11
240.	-7.17	-6.85	-5.75	-1.42	-0.32	-1.10
250.	-6.92	-6.60	-5.50	-1.42	-0.32	-1.10
260.	-6.66	-6.33	-5.23	-1.43	-0.33	-1.10
270.	-6.37	-6.05	-4.95	-1.42	-0.32	-1.10
280.	-6.09	-5.76	-4.66	-1.43	-0.33	-1.10
290.	-5.87	-5.54	-4.44	-1.43	-0.33	-1.10
300.	-5.63	-5.31	-4.21	-1.42	-0.32	-1.10
340.	-4.59	-4.27	-3.16	-1.43	-0.32	-1.11
375.	-3.77	-3.45	-2.35	-1.42	-0.32	-1.10
425.	-2.74	-2.42	-1.32	-1.42	-0.32	-1.10
475.	-1.82	-1.50	-0.39	-1.43	-0.32	-1.11

TABLE V

LEVEL OF NO MOTION ANALYSIS

NOVEMBER 1973 - STATIONS 307-303

DEPTH - - - - - - - - - - - VELOCITIES - - - - - - - - - - -

(METERS) - - - - - - - - - - - - (CM./SEC.) - - - - - - - - - - -

Z	VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	6.20	5.23	3.41	2.79	0.97	1.82
10.	6.37	5.40	3.57	2.80	0.97	1.83
20.	6.57	5.60	3.77	2.80	0.97	1.83
30.	6.81	5.84	4.01	2.80	0.97	1.83
40.	7.25	6.28	4.46	2.79	0.97	1.82
50.	8.17	7.20	5.38	2.79	0.97	1.82
60.	8.57	7.60	5.77	2.80	0.97	1.83
70.	8.76	7.79	5.97	2.79	0.97	1.82
80.	8.81	7.85	6.02	2.79	0.96	1.83
90.	8.76	7.79	5.96	2.80	0.97	1.83
100.	8.79	7.82	5.99	2.80	0.97	1.83
110.	8.76	7.79	5.96	2.80	0.97	1.83
120.	8.73	7.76	5.94	2.79	0.97	1.82
130.	8.63	7.66	5.84	2.79	0.97	1.82
140.	8.55	7.58	5.76	2.79	0.97	1.82
150.	8.52	7.55	5.72	2.80	0.97	1.83
160.	8.51	7.55	5.72	2.79	0.96	1.83
170.	8.61	7.64	5.82	2.79	0.97	1.82
180.	8.76	7.79	5.96	2.80	0.97	1.83
190.	8.94	7.97	6.14	2.80	0.97	1.83
200.	9.16	8.19	6.37	2.79	0.97	1.82
210.	9.34	8.37	6.54	2.80	0.97	1.83
220.	9.43	8.46	6.64	2.79	0.97	1.82
230.	9.49	8.52	6.70	2.79	0.97	1.82
240.	9.55	8.58	6.75	2.80	0.97	1.83
250.	9.61	8.64	6.81	2.80	0.97	1.83
260.	9.68	8.71	6.88	2.80	0.97	1.83
270.	9.67	8.70	6.87	2.80	0.97	1.83
280.	9.48	8.51	6.69	2.79	0.97	1.82
290.	9.39	8.42	6.60	2.79	0.97	1.82
300.	9.17	8.20	6.37	2.80	0.97	1.83
340.	7.66	6.69	4.86	2.80	0.97	1.83
375.	6.76	5.79	3.97	2.79	0.97	1.82
425.	5.10	4.13	2.31	2.79	0.97	1.82
475.	3.44	2.47	0.64	2.80	0.97	1.83

TABLE VI

LEVEL OF NO MOTION ANALYSIS

DECEMBER 1973 - STATIONS 307-303

DEPTH (METERS) Z	VELOCITIES (CM./SEC.) VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	-8.21	-6.17	-5.22	-2.99	-2.04	-0.95
10.	-7.92	-5.89	-4.93	-2.99	-2.03	-0.96
20.	-7.57	-5.54	-4.58	-2.99	-2.03	-0.96
30.	-7.01	-4.97	-4.01	-3.00	-2.04	-0.96
40.	-6.06	-4.02	-3.06	-3.00	-2.04	-0.96
50.	-4.75	-2.71	-1.75	-3.00	-2.04	-0.96
60.	-3.91	-1.87	-0.92	-2.99	-2.04	-0.95
70.	-3.35	-1.31	-0.35	-3.00	-2.04	-0.96
80.	-2.93	-0.89	0.07	-3.00	-2.04	-0.96
90.	-2.51	-0.47	0.49	-3.00	-2.04	-0.96
100.	-1.84	0.20	1.16	-3.00	-2.04	-0.96
110.	-1.20	0.84	1.80	-3.00	-2.04	-0.96
120.	-0.82	1.22	2.18	-3.00	-2.04	-0.96
130.	-0.48	1.56	2.52	-3.00	-2.04	-0.96
140.	-0.16	1.87	2.83	-2.99	-2.03	-0.96
150.	0.18	2.22	3.18	-3.00	-2.04	-0.96
160.	0.54	2.58	3.54	-3.00	-2.04	-0.96
170.	0.80	2.83	3.79	-2.99	-2.03	-0.96
180.	0.81	2.85	3.81	-3.00	-2.04	-0.96
190.	0.65	2.69	3.65	-3.00	-2.04	-0.96
200.	0.42	2.46	3.41	-2.99	-2.04	-0.95
210.	0.22	2.26	3.22	-3.00	-2.04	-0.96
220.	0.04	2.08	3.04	-3.00	-2.04	-0.96
230.	-0.05	1.98	2.94	-2.99	-2.03	-0.96
240.	-0.12	1.91	2.87	-2.99	-2.03	-0.96
250.	-0.22	1.82	2.78	-3.00	-2.04	-0.96
260.	-0.32	1.71	2.67	-2.99	-2.03	-0.96
270.	-0.41	1.63	2.58	-2.99	-2.04	-0.95
280.	-0.49	1.54	2.50	-2.99	-2.03	-0.96
290.	-0.59	1.45	2.41	-3.00	-2.04	-0.96
300.	-0.71	1.33	2.29	-3.00	-2.04	-0.96
340.	-0.99	1.05	2.00	-2.99	-2.04	-0.95
375.	-1.19	0.85	1.80	-2.99	-2.04	-0.95
425.	-1.91	0.12	1.08	-2.99	-2.03	-0.96
475.	-2.85	-0.81	0.15	-3.00	-2.04	-0.96

TABLE VII

LEVEL OF NO MOTION ANALYSIS

JANUARY 1974 - STATIONS 317-307

DEPTH (METERS) Z	VELOCITIES (CM./SEC.) VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	-13.66	-13.63	-13.63	-0.03	-0.03	0.0
10.	-14.41	-14.38	-14.38	-0.03	-0.03	0.0
20.	-15.22	-15.20	-15.19	-0.03	-0.02	-0.01
30.	-16.03	-16.01	-16.00	-0.03	-0.02	-0.01
40.	-16.45	-16.42	-16.42	-0.03	-0.03	0.0
50.	-15.98	-15.96	-15.95	-0.03	-0.02	-0.01
60.	-15.29	-15.27	-15.27	-0.02	-0.02	0.0
70.	-14.42	-14.39	-14.39	-0.03	-0.03	0.0
80.	-13.52	-13.50	-13.49	-0.03	-0.02	-0.01
90.	-12.58	-12.56	-12.55	-0.03	-0.02	-0.01
100.	-11.65	-11.63	-11.62	-0.03	-0.02	-0.01
110.	-10.80	-10.78	-10.77	-0.03	-0.02	-0.01
120.	-10.01	-9.98	-9.98	-0.03	-0.03	0.0
130.	-9.19	-9.16	-9.16	-0.03	-0.03	0.0
140.	-8.36	-8.34	-8.33	-0.03	-0.02	-0.01
150.	-7.57	-7.54	-7.54	-0.03	-0.03	0.0
160.	-6.78	-6.75	-6.75	-0.03	-0.03	0.0
170.	-6.06	-6.04	-6.03	-0.03	-0.02	-0.01
180.	-5.41	-5.39	-5.39	-0.02	-0.02	0.0
190.	-4.82	-4.79	-4.79	-0.03	-0.03	0.0
200.	-4.26	-4.24	-4.23	-0.03	-0.02	-0.01
210.	-3.75	-3.73	-3.72	-0.03	-0.02	-0.01
220.	-3.30	-3.27	-3.27	-0.03	-0.03	0.0
230.	-2.93	-2.91	-2.90	-0.03	-0.02	-0.01
240.	-2.67	-2.64	-2.64	-0.03	-0.03	0.0
250.	-2.44	-2.41	-2.41	-0.03	-0.03	0.0
260.	-2.23	-2.20	-2.20	-0.03	-0.03	0.0
270.	-2.04	-2.02	-2.01	-0.03	-0.02	-0.01
280.	-1.86	-1.83	-1.83	-0.03	-0.03	0.0
290.	-1.67	-1.65	-1.64	-0.03	-0.02	-0.01
300.	-1.45	-1.43	-1.42	-0.03	-0.02	-0.01
340.	-0.82	-0.80	-0.79	-0.03	-0.02	-0.01
375.	-0.48	-0.45	-0.45	-0.03	-0.03	0.0
425.	-0.18	-0.16	-0.15	-0.03	-0.02	-0.01
475.	-0.04	-0.02	-0.01	-0.03	-0.02	-0.01

TABLE VIII

LEVEL OF NO MOTION ANALYSIS

JANUARY 1974 - STATIONS 307-303

DEPTH (METERS) Z	VELOCITIES (CM./SEC.) VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	8.06	9.28	9.55	-1.49	-1.22	-0.27
10.	9.21	10.43	10.70	-1.49	-1.22	-0.27
20.	9.93	11.15	11.42	-1.49	-1.22	-0.27
30.	10.28	11.51	11.77	-1.49	-1.23	-0.26
40.	10.50	11.73	12.00	-1.50	-1.23	-0.27
50.	10.69	11.92	12.19	-1.50	-1.23	-0.27
60.	10.82	12.04	12.31	-1.49	-1.22	-0.27
70.	10.86	12.08	12.35	-1.49	-1.22	-0.27
80.	11.09	12.32	12.59	-1.50	-1.23	-0.27
90.	11.56	12.78	13.05	-1.49	-1.22	-0.27
100.	12.00	13.22	13.49	-1.49	-1.22	-0.27
110.	12.48	13.70	13.97	-1.49	-1.22	-0.27
120.	12.89	14.11	14.38	-1.49	-1.22	-0.27
130.	12.92	14.15	14.42	-1.50	-1.23	-0.27
140.	12.39	13.61	13.88	-1.49	-1.22	-0.27
150.	11.48	12.70	12.97	-1.49	-1.22	-0.27
160.	10.21	11.44	11.71	-1.50	-1.23	-0.27
170.	8.97	10.20	10.47	-1.50	-1.23	-0.27
180.	7.79	9.02	9.29	-1.50	-1.23	-0.27
190.	6.60	7.83	8.10	-1.50	-1.23	-0.27
200.	5.45	6.68	6.95	-1.50	-1.23	-0.27
210.	4.28	5.50	5.77	-1.49	-1.22	-0.27
220.	3.15	4.37	4.64	-1.49	-1.22	-0.27
230.	2.26	3.48	3.75	-1.49	-1.22	-0.27
240.	1.61	2.84	3.10	-1.49	-1.23	-0.26
250.	1.09	2.32	2.59	-1.50	-1.23	-0.27
260.	0.60	1.83	2.10	-1.50	-1.23	-0.27
270.	0.18	1.40	1.67	-1.49	-1.22	-0.27
280.	-0.25	0.97	1.24	-1.49	-1.22	-0.27
290.	-0.65	0.57	0.84	-1.49	-1.22	-0.27
300.	-1.06	0.16	0.43	-1.49	-1.22	-0.27
340.	-1.72	-0.50	-0.23	-1.49	-1.22	-0.27
375.	-1.91	-0.68	-0.42	-1.49	-1.23	-0.26
425.	-1.77	-0.55	-0.28	-1.49	-1.22	-0.27
475.	-1.60	-0.38	-0.11	-1.49	-1.22	-0.27

TABLE IX

LEVEL OF NO MOTION ANALYSIS

AUGUST 1974 - STATIONS 317-307

DEPTH (METERS) Z	VELOCITIES (CM./SEC.) VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	-2.22	-1.33	-0.28	-1.94	-0.89	-1.05
10.	-2.30	-1.42	-0.36	-1.94	-0.88	-1.06
20.	-2.40	-1.51	-0.46	-1.94	-0.89	-1.05
30.	-2.78	-1.89	-0.84	-1.94	-0.89	-1.05
40.	-3.41	-2.53	-1.48	-1.93	-0.88	-1.05
50.	-3.76	-2.87	-1.82	-1.94	-0.89	-1.05
60.	-4.11	-3.22	-2.17	-1.94	-0.89	-1.05
70.	-4.34	-3.45	-2.40	-1.94	-0.89	-1.05
80.	-4.48	-3.60	-2.55	-1.93	-0.88	-1.05
90.	-4.56	-3.68	-2.62	-1.94	-0.88	-1.06
100.	-4.50	-3.62	-2.56	-1.94	-0.88	-1.06
110.	-4.39	-3.51	-2.46	-1.93	-0.88	-1.05
120.	-4.35	-3.47	-2.42	-1.93	-0.88	-1.05
130.	-4.31	-3.43	-2.38	-1.93	-0.88	-1.05
140.	-4.32	-3.44	-2.38	-1.94	-0.88	-1.06
150.	-4.26	-3.38	-2.32	-1.94	-0.88	-1.06
160.	-4.23	-3.35	-2.30	-1.93	-0.88	-1.05
170.	-4.22	-3.34	-2.28	-1.94	-0.88	-1.06
180.	-4.22	-3.33	-2.28	-1.94	-0.89	-1.05
190.	-4.20	-3.32	-2.27	-1.93	-0.88	-1.05
200.	-4.17	-3.29	-2.24	-1.93	-0.88	-1.05
210.	-4.15	-3.26	-2.21	-1.94	-0.89	-1.05
220.	-4.12	-3.24	-2.19	-1.93	-0.88	-1.05
230.	-4.12	-3.24	-2.19	-1.93	-0.88	-1.05
240.	-4.12	-3.23	-2.18	-1.94	-0.89	-1.05
250.	-4.11	-3.23	-2.18	-1.93	-0.88	-1.05
260.	-4.12	-3.24	-2.19	-1.93	-0.88	-1.05
270.	-4.13	-3.25	-2.19	-1.94	-0.88	-1.06
280.	-4.11	-3.23	-2.17	-1.94	-0.88	-1.06
290.	-4.08	-3.19	-2.14	-1.94	-0.89	-1.05
300.	-4.04	-3.16	-2.11	-1.93	-0.88	-1.05
340.	-3.79	-2.91	-1.85	-1.94	-0.88	-1.06
375.	-3.47	-2.59	-1.54	-1.93	-0.88	-1.05
425.	-2.83	-1.94	-0.89	-1.94	-0.89	-1.05
475.	-2.22	-1.33	-0.28	-1.94	-0.89	-1.05

TABLE X

LEVEL OF NO MOTION ANALYSIS

AUGUST 1974 - STATIONS 307-303

DEPTH (METERS) Z	VELOCITIES (CM./SEC.) VEL.7,Z	VEL.6,Z	VEL.5,Z	VEL.7,5	VEL.7,6	VEL.6,5
0.	-18.97	-15.56	-11.88	-7.09	-3.41	-3.68
10.	-19.03	-15.61	-11.93	-7.10	-3.42	-3.68
20.	-19.16	-15.75	-12.06	-7.10	-3.41	-3.69
30.	-19.22	-15.80	-12.12	-7.10	-3.42	-3.68
40.	-19.12	-15.70	-12.02	-7.10	-3.42	-3.68
50.	-19.15	-15.74	-12.06	-7.09	-3.41	-3.68
60.	-18.82	-15.41	-11.73	-7.09	-3.41	-3.68
70.	-18.41	-14.99	-11.31	-7.10	-3.42	-3.68
80.	-17.98	-14.56	-10.88	-7.10	-3.42	-3.68
90.	-17.84	-14.42	-10.74	-7.10	-3.42	-3.68
100.	-17.70	-14.29	-10.60	-7.10	-3.41	-3.69
110.	-17.49	-14.07	-10.39	-7.10	-3.42	-3.68
120.	-17.19	-13.78	-10.10	-7.09	-3.41	-3.68
130.	-16.86	-13.45	-9.77	-7.09	-3.41	-3.68
140.	-16.63	-13.21	-9.53	-7.10	-3.42	-3.68
150.	-16.47	-13.05	-9.37	-7.10	-3.42	-3.68
160.	-16.22	-12.80	-9.12	-7.10	-3.42	-3.68
170.	-16.00	-12.58	-8.90	-7.10	-3.42	-3.68
180.	-15.78	-12.36	-8.68	-7.10	-3.42	-3.68
190.	-15.51	-12.10	-8.42	-7.09	-3.41	-3.68
200.	-15.23	-11.81	-8.13	-7.10	-3.42	-3.68
210.	-14.95	-11.54	-7.85	-7.10	-3.41	-3.69
220.	-14.72	-11.30	-7.62	-7.10	-3.42	-3.68
230.	-14.49	-11.08	-7.40	-7.09	-3.41	-3.68
240.	-14.27	-10.86	-7.17	-7.10	-3.41	-3.69
250.	-13.97	-10.56	-6.87	-7.10	-3.41	-3.69
260.	-13.65	-10.23	-6.55	-7.10	-3.42	-3.68
270.	-13.33	-9.91	-6.23	-7.10	-3.42	-3.68
280.	-12.99	-9.57	-5.89	-7.10	-3.42	-3.68
290.	-12.65	-9.23	-5.55	-7.10	-3.42	-3.68
300.	-12.32	-8.91	-5.23	-7.09	-3.41	-3.68
340.	-11.23	-7.81	-4.13	-7.10	-3.42	-3.68
375.	-10.32	-6.91	-3.22	-7.10	-3.41	-3.69
425.	-9.17	-5.75	-2.07	-7.10	-3.42	-3.68
475.	-7.84	-4.43	-0.75	-7.09	-3.41	-3.68

Z = depth (m)

VEL.Z = absolute velocity at Z (cm/sec).[1]

VEL.7 = absolute velocity at Z = 700 m (cm/sec)

VEL.5 = absolute velocity at Z = 500 m (cm/sec)

VEL.7,Z = velocity at Z relative to 700 m (cm/sec)

VEL.5,Z = velocity at Z relative to 500 m (cm/sec)

VEL.7,5 = velocity at 500 m relative to velocity at 700 m or the velocity shear between Z = 500 m and Z = 700 m

VEL.6,5 = velocity at 500 m relative to velocity at 600 m or the velocity shear between Z = 500 m and Z = 600 m

The preceding variables are related to each other in that the absolute velocity at any depth, Z, is equal to the absolute velocity at Z = 700 m plus the velocity at Z relative to 700 m, or symbolically,

$$VEL.Z = VEL.7 + VEL.7,Z \quad (4)$$

similarly,

$$VEL.Z = VEL.6 + VEL.6,Z \quad (5)$$

$$VEL.Z = VEL.5 + VEL.5,Z \quad (6)$$

subtracting equation (6) from (4),

$$0 = VEL.7 - VEL.5 + VEL.7,Z - VEL.5,Z$$

or,

$$VEL.5 - VEL.7 = VEL.7,Z - VEL.5,Z \quad (7)$$

---

[1] In fact, velocities are defined on isobaric surfaces where the pressure in db is roughly the same numerically as the given depth in meters. Negative velocities indicate flow to the north in Tables II through X.

but the left-hand side of equation (7) is the velocity shear between Z = 500 m and Z = 700 m or,

$$VEL.7,5 = VEL.7,Z - VEL.5,Z$$

The velocities at Z relative to 700 db, 600 db and 500 db are known from dynamic method computations. Thus the velocity shears which provide quantitative differences between the two levels are known. Now, assuming that the 500 db level is the reference level which provides velocities which nearly approximate the actual flow, then comparison of the velocity shears, VEL.7,5 and VEL.6,5, to the velocity at Z relative to 500 m, VEL.5,Z, respectively, provides a velocity error percentage. For example, Table II shows that if one chose 700 db as a reference level instead of 500 db, the assumed correct level, the calculated surface currents would differ by 37 percent. As expected, the difference percentage tends to increase with greater depths.

In summary, Tables II through X show quantitatively that there are considerable differences in current speeds obtained from geostrophy using 500 db, 600 db, and 700 db as the reference levels. Consequently, if the objective of a study is to obtain current speeds which are correct in magnitude, the selection of a 'level of no motion' should not be a matter of choice but of direct measurement, and of data corroboration via independent measurements. The apparent influence of bottom topography on the flow (see subsection B in Discussion and Results) also suggests that motion persists rather deeper than 500 db and that there may be no simple 'level of no motion'.

B. PATTERNS OF CURRENT FLOW AND THEIR STRUCTURE WITH DEPTH

The patterns of current flow are inferred from geostrophy with respect to the 500 db surface. To obtain a pictorial representation of the current flow and its structure with depth, dynamic heights for data stations along three constant latitude lines, 36^{o} 20'N, 36^{o} 30'N and 36^{o} 40'N, were plotted and height contours drawn for the isobaric surface, 50 db, 100 db, 200 db, 300 db, 375 db and the 425 db surfaces during August 1973. These dynamic height contours of the various surfaces above are shown in figures 3 through 9. The contour lines are labeled with their respective dynamic height values in dynamic centimeters. The contour intervals for each of figures 3 through 9 are different. Consequently, caution should be exercised when interpreting the figures for speed. For example, the closely spaced contours in figures 8 and 9 do not indicate an intense circulation.

Unfortunately, this analysis could not be accomplished for data months other than August 1973 since data observations were made predominantly along one constant latitude line, 36^{o} 40'N, during months September 1973 through August 1974. However, the contours clearly reveal some interesting features of the patterns of the current flow and their structure with depth during August 1973.

The prominent features depicted in figures 3 through 9 are,

(1) The flow branches into a northwesterly and an east-southeasterly component just north of 36^{o} 30'N at all seven depths from the surface to 425 meters.

(2) The general pattern of current flow is similar for all depths from the surface to 375 meters.

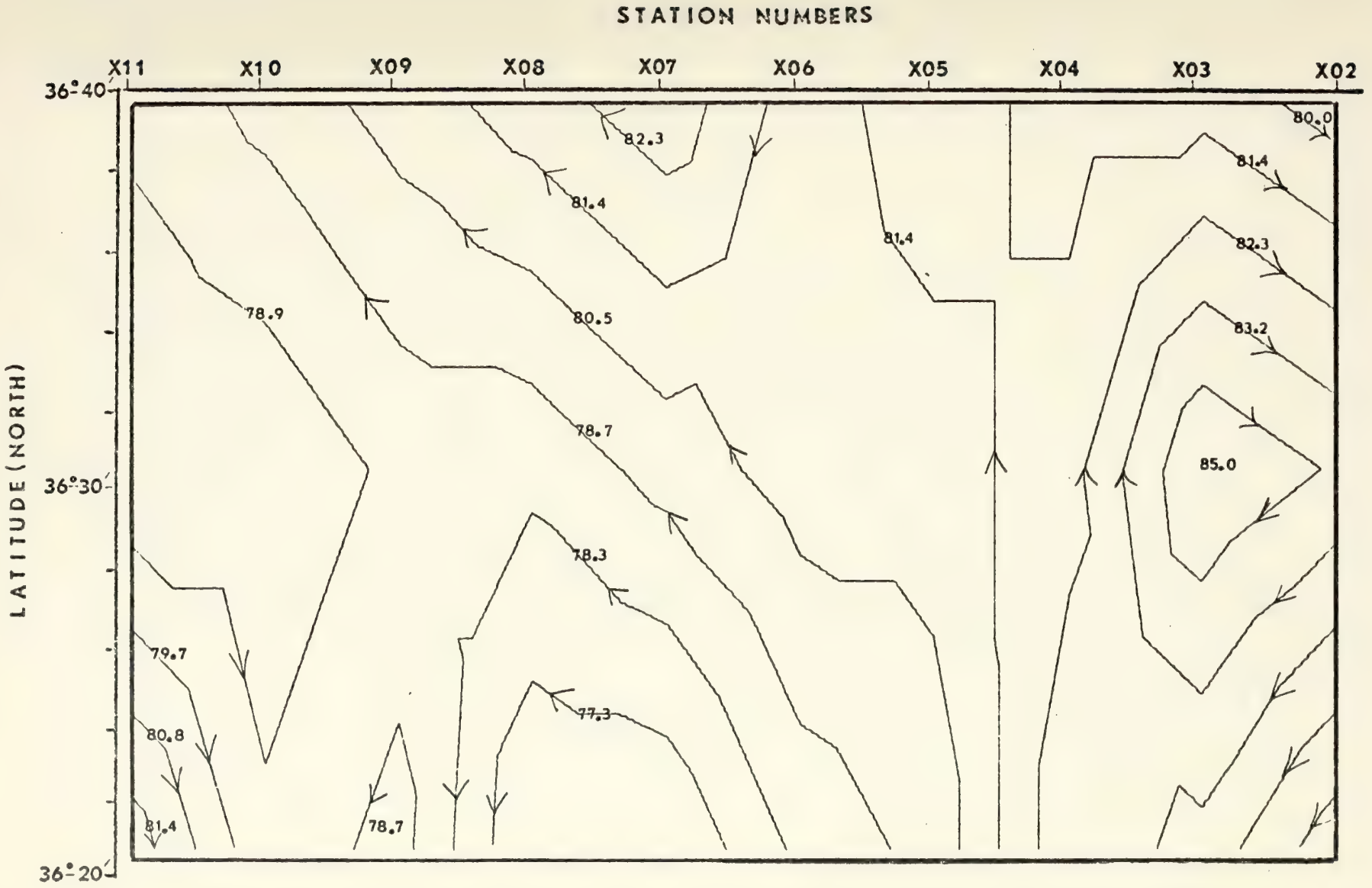


Fig. 3. Dynamic Height Contours at the Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

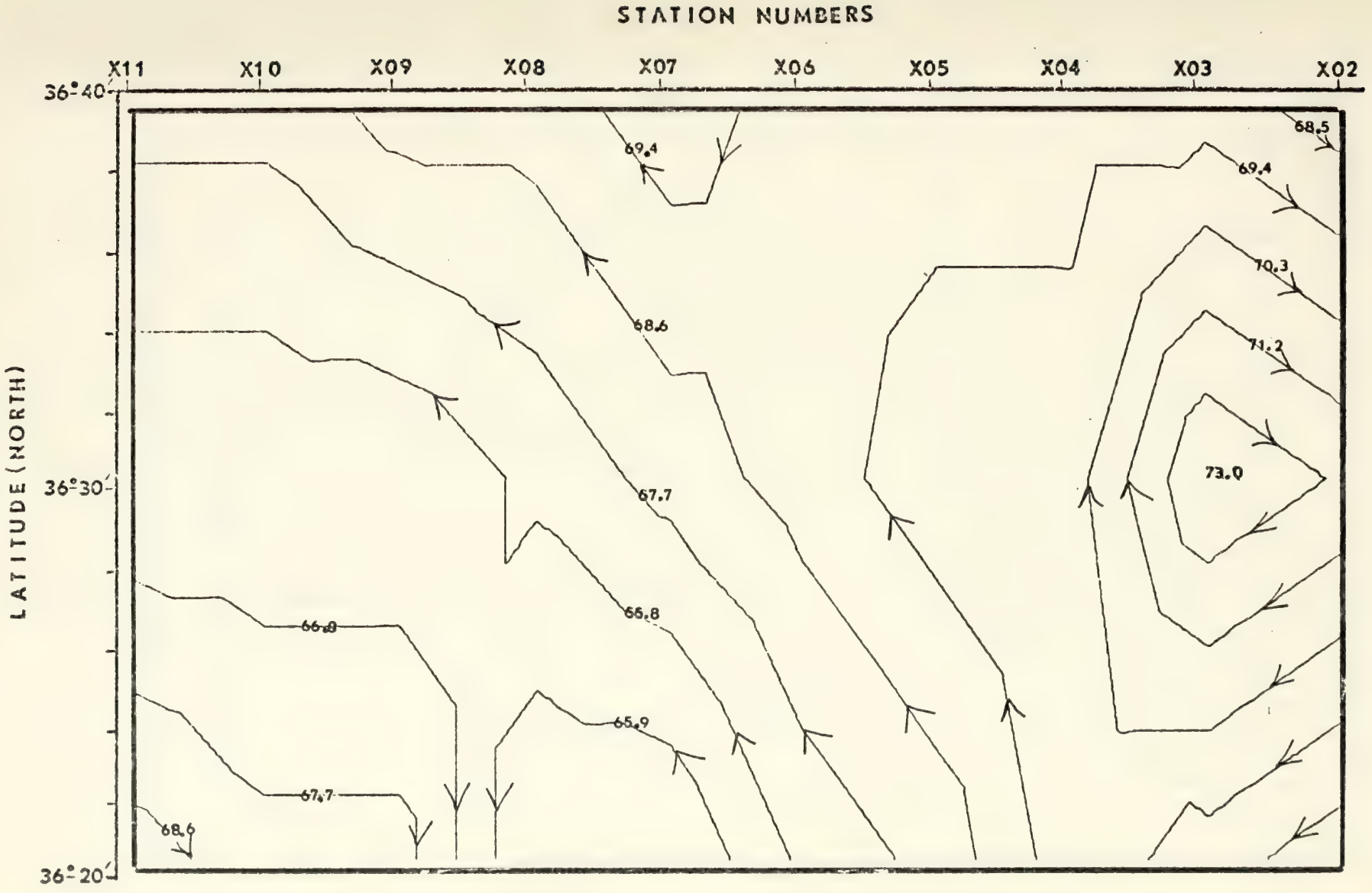


Fig. 4. Dynamic Height Contours of the 50 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

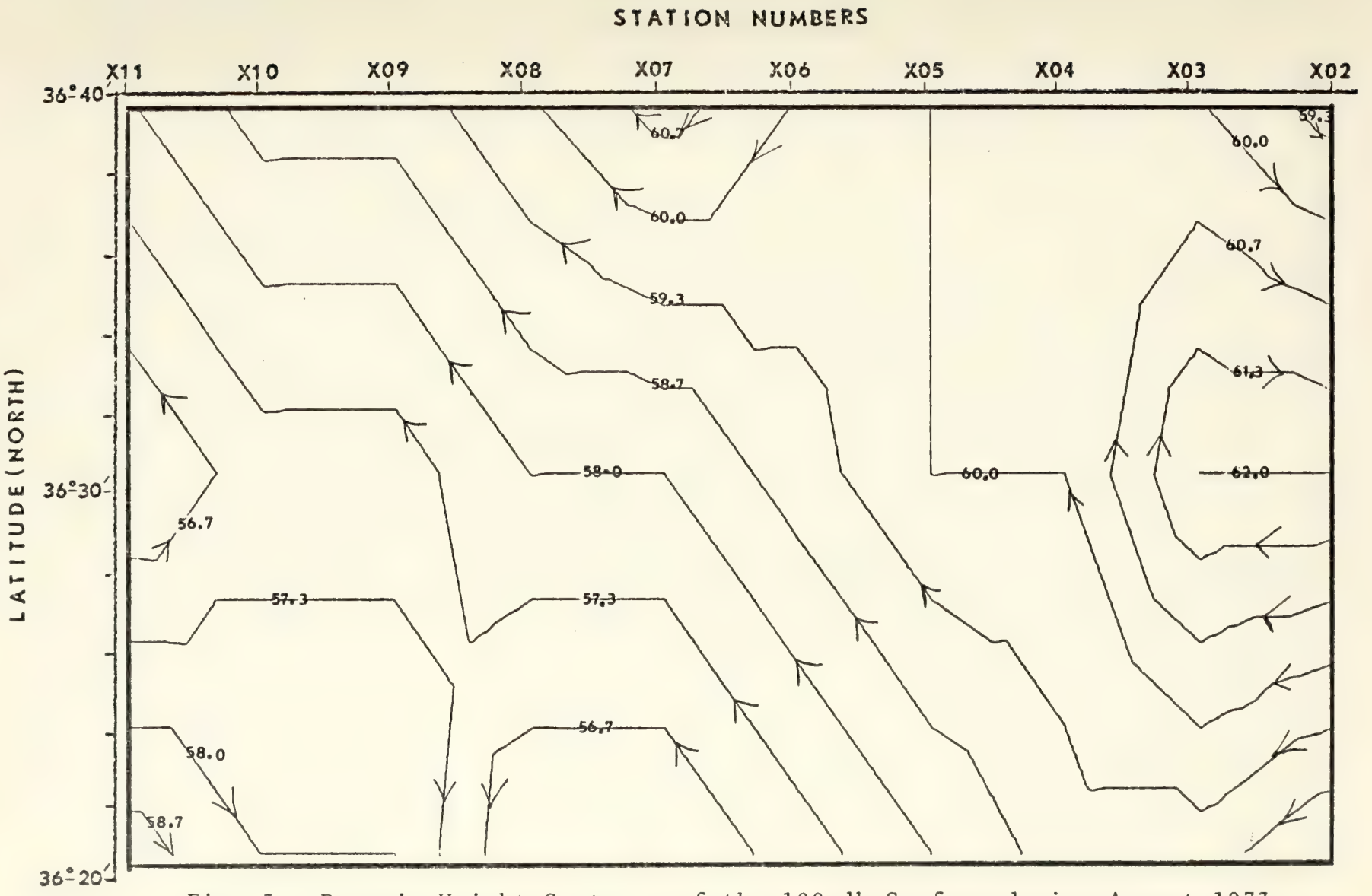


Fig. 5. Dynamic Height Contours of the 100 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

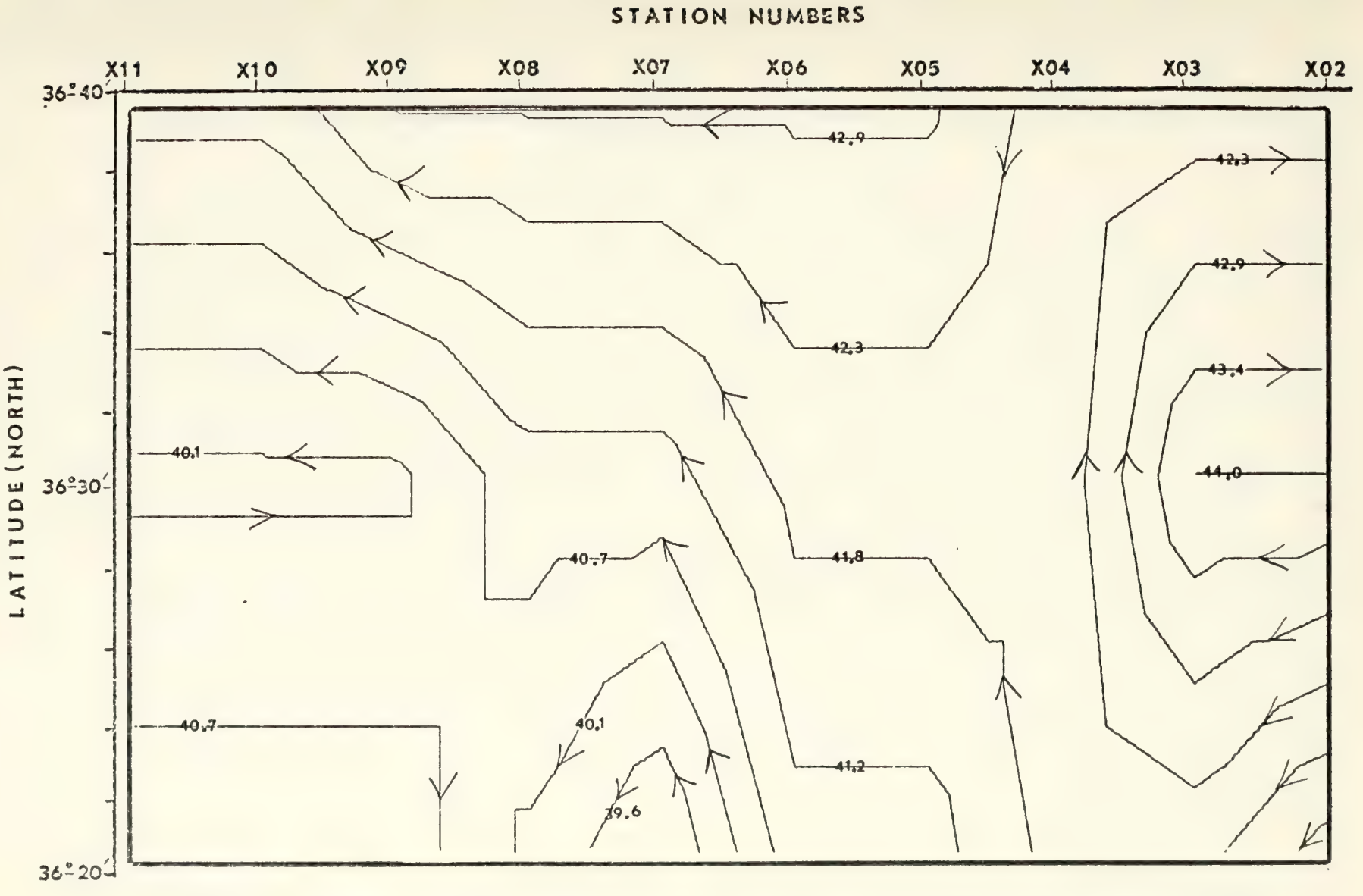


Fig. 6. Dynamic Height Contours of the 200 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

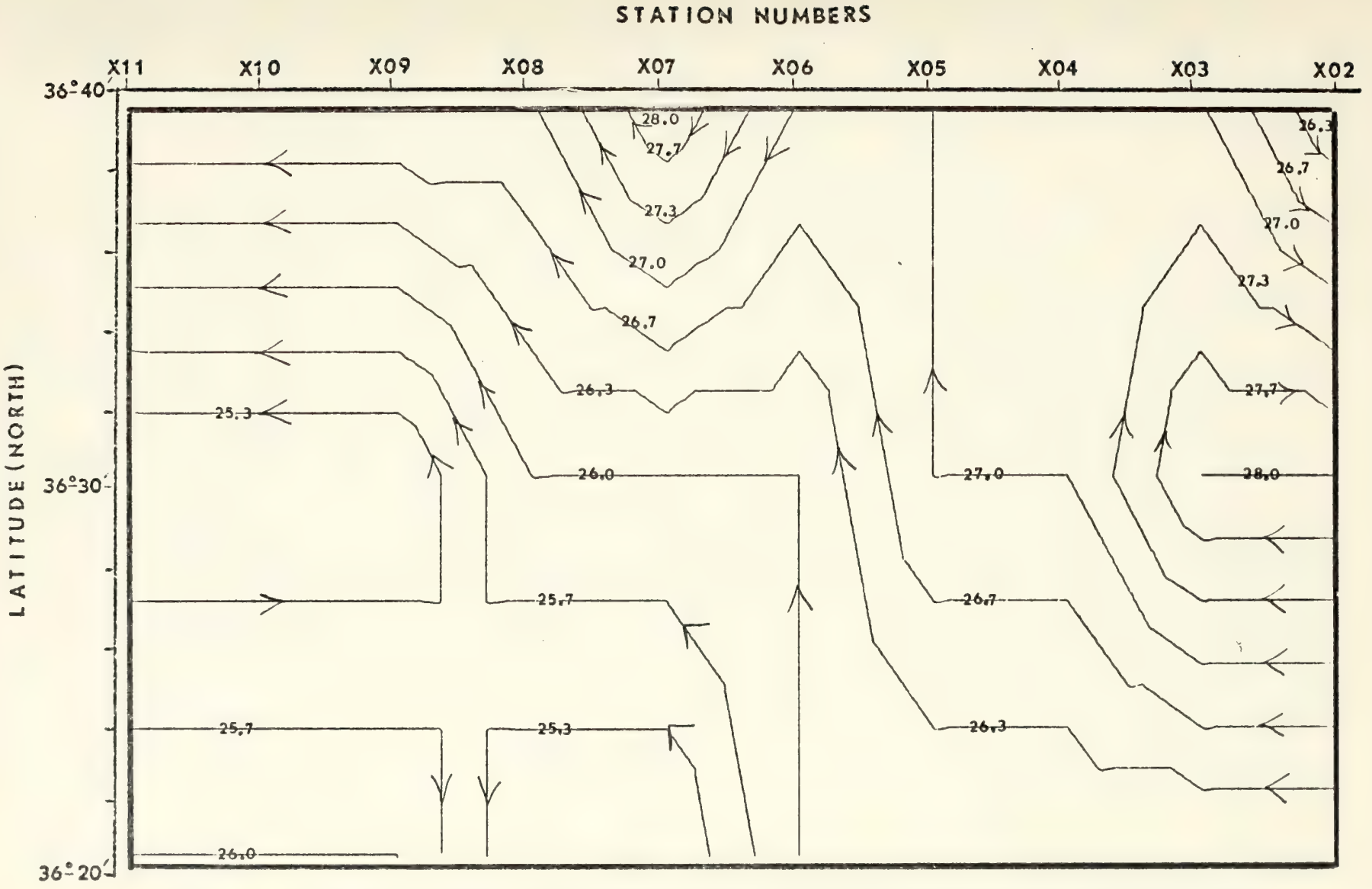


Fig. 7. Dynamic Height Contours of the 300 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

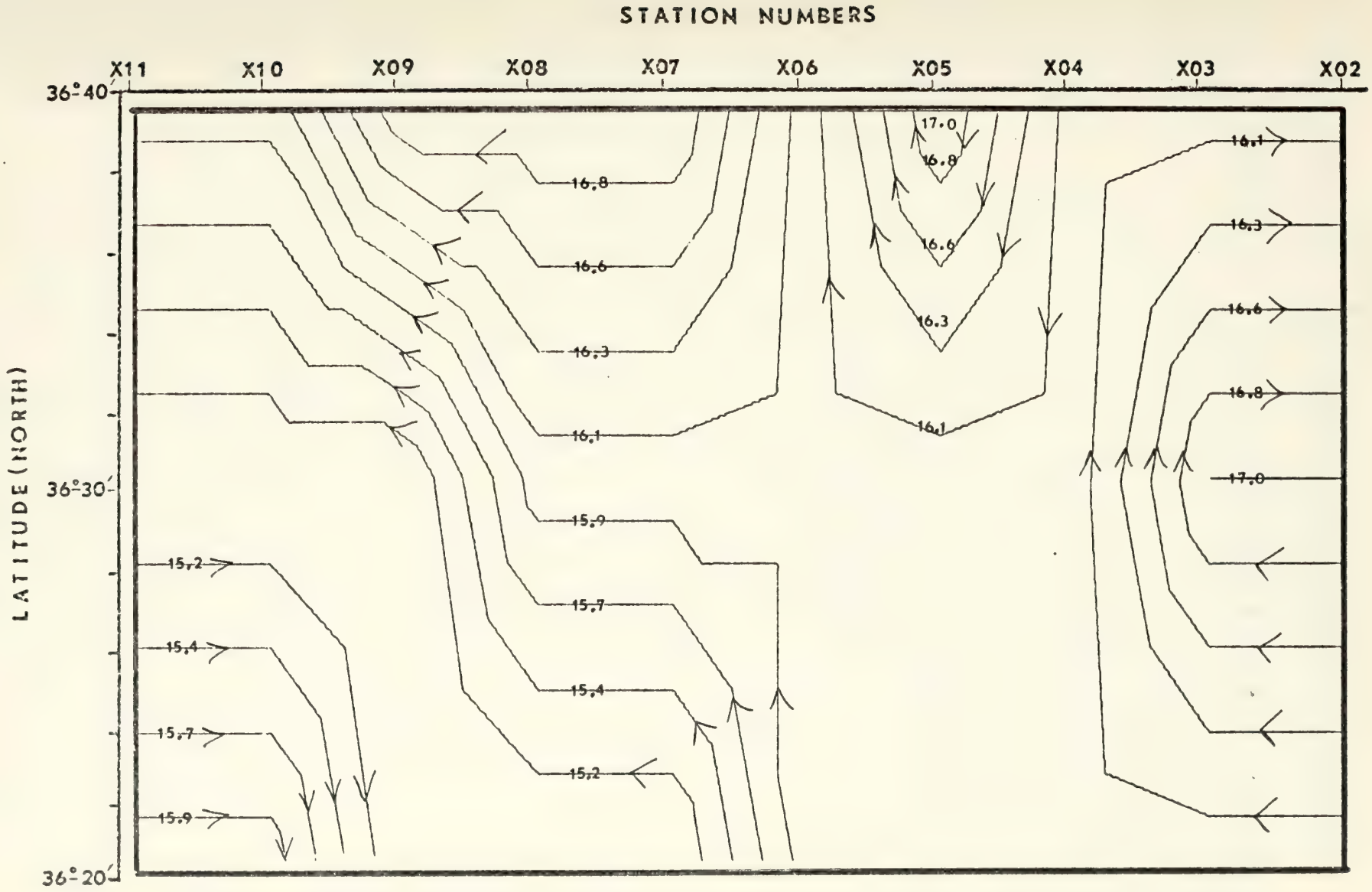


Fig. 8. Dynamic Height Contours of the 375 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

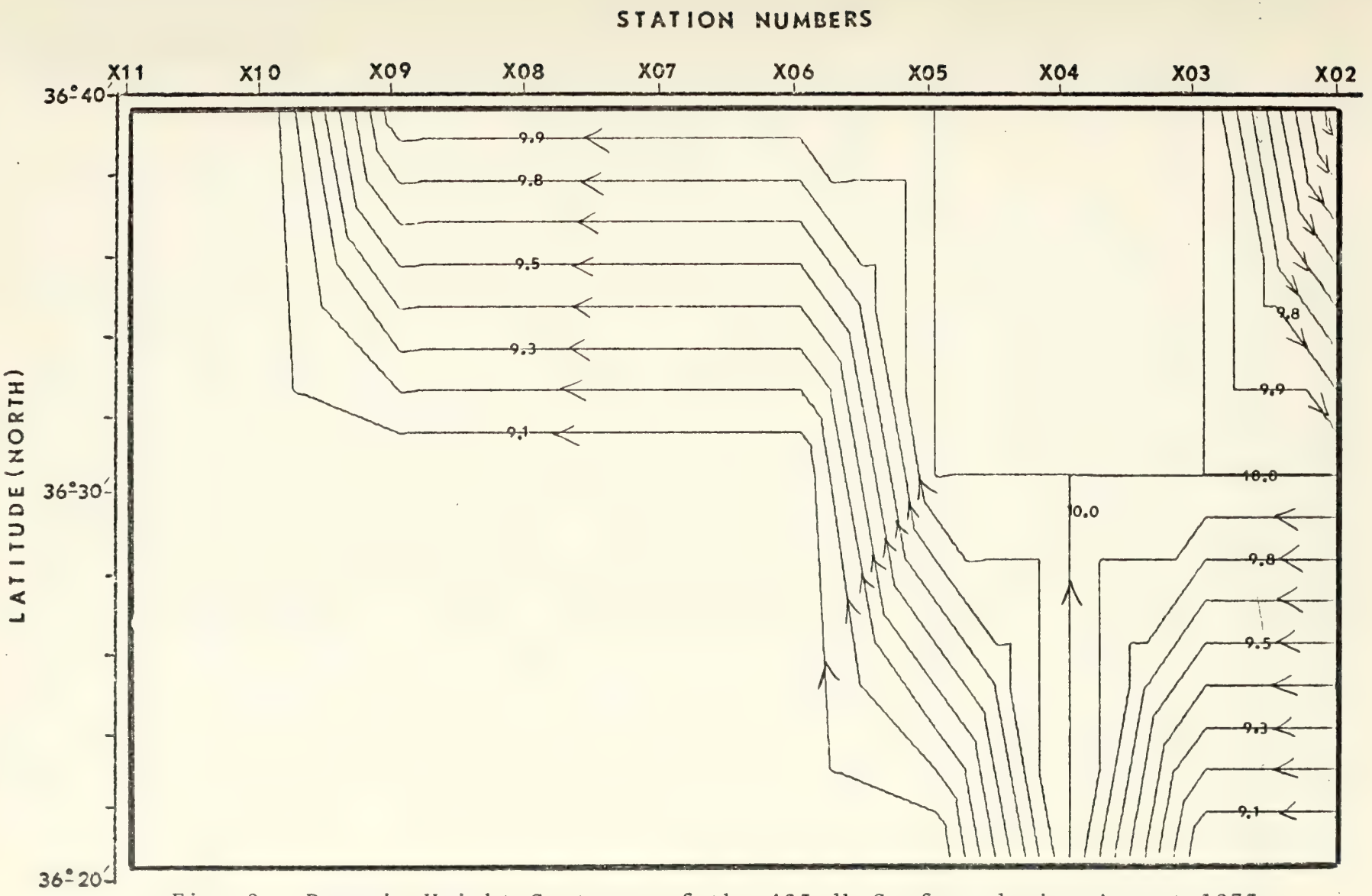


Fig. 9. Dynamic Height Contours of the 425 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

(3) The flow is more intense south of latitude 36° 30'N as evidenced by the dynamic height contour spacing.

(4) The narrow band of poleward flow in the vicinity of longitude 122° 18'W, near stations 106 and 206, appears to be topographically controlled.

Figure 10 depicts the general pattern of current flow relative to the local bathymetry. Figures 3 through 10 suggest that the course of the currents in this area is controlled in part by the local bottom topography. This is evidenced in the following ways,

(1) The flow follows the general north-south topographical orientation south of 36° 30'N.

(2) The flow branches north of 36° 30'N, and follows the generally east-west bathymetric contours.

Furthermore, the currents in the northwest sector of the area appear not to be topographically controlled. This can be explained by the fact that the current speed for the most part is small near 500 m, and it would be difficult to see how bottom topography at depths greater than 1,000 fathoms could influence the currents in this sector. However, in the northeastern sector, where depth decreases toward the coastline, the currents appear to be topographically controlled and follow the principle of conservation of potential vorticity.

Now consider the validity of the current flow inferred from geostrophy. Independent current flow measurements were made using parachute drogues during August 1972 and August 1973 by Wickham [1975]. Drogue trajectories, especially in 1972, confirm that the flow branches into two components, and there appears to be a narrow band of poleward flow in the vicinity of longitude 122° 18'W; and the drogue paths in

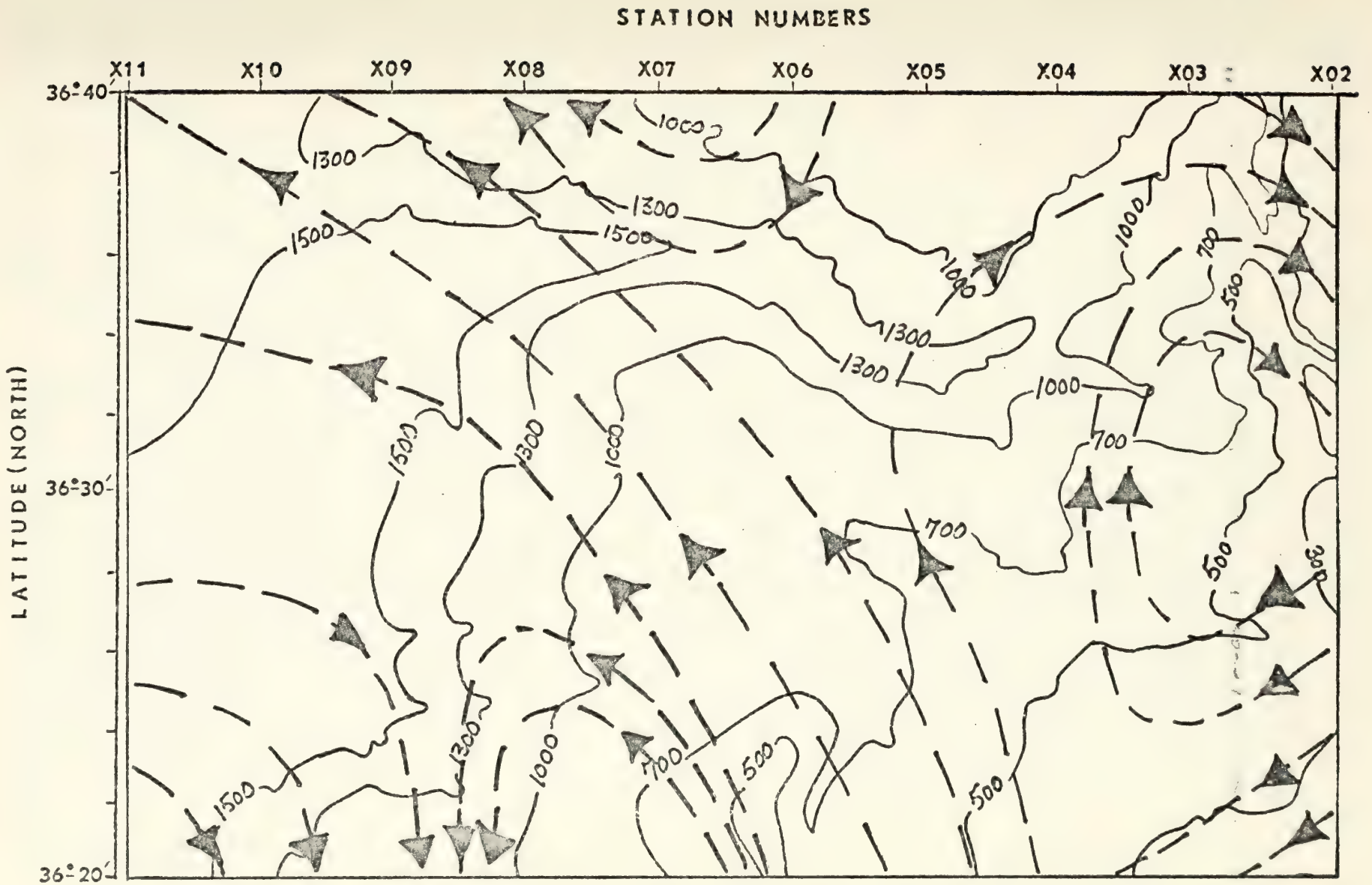


Fig. 10. General Pattern of Geostrophic Current Flow during August 1973.

August 1973 tend to confirm a broader poleward flow towards the west. There is also indication in the drogue paths in August 1972 of a strong shear zone and a cyclonic eddy of similar scale to that shown by geostrophy in 1973.

C. TEMPORAL VARIATION OF THE GEOSTROPHIC FLOW

The variation of the geostrophic flow with time is inferred from geostrophic calculations with respect to the 500 db surface. Specifically, dynamic heights were calculated for stations along constant latitude line, 36^{o} 40'N, during each month. These dynamic heights were used to generate a two-dimensional array with the abscissa and ordinate axes specified as station numbers and time, respectively. Dynamic height contours were then constructed for several isobaric surfaces and the geostrophic flow normal to the station line inferred from the contours.

Originally, the dynamic height contours with time were to depict temporal variations over the entire observation period, August 1973 through August 1974. However, the time period had to be divided into two segments due to programming constraints of the program routine, CONTUR. Specifically, the program will contour only the dynamic height values of data months which have an equal number of data stations. Consequently, data months February, June and July 1974, which have dynamic height calculations based on only three Nansen data stations, (vice 16 STD stations for the other months) prohibited depicting variation of flow over the entire time period. Therefore figures 11 through 16, which were constructed from dynamic

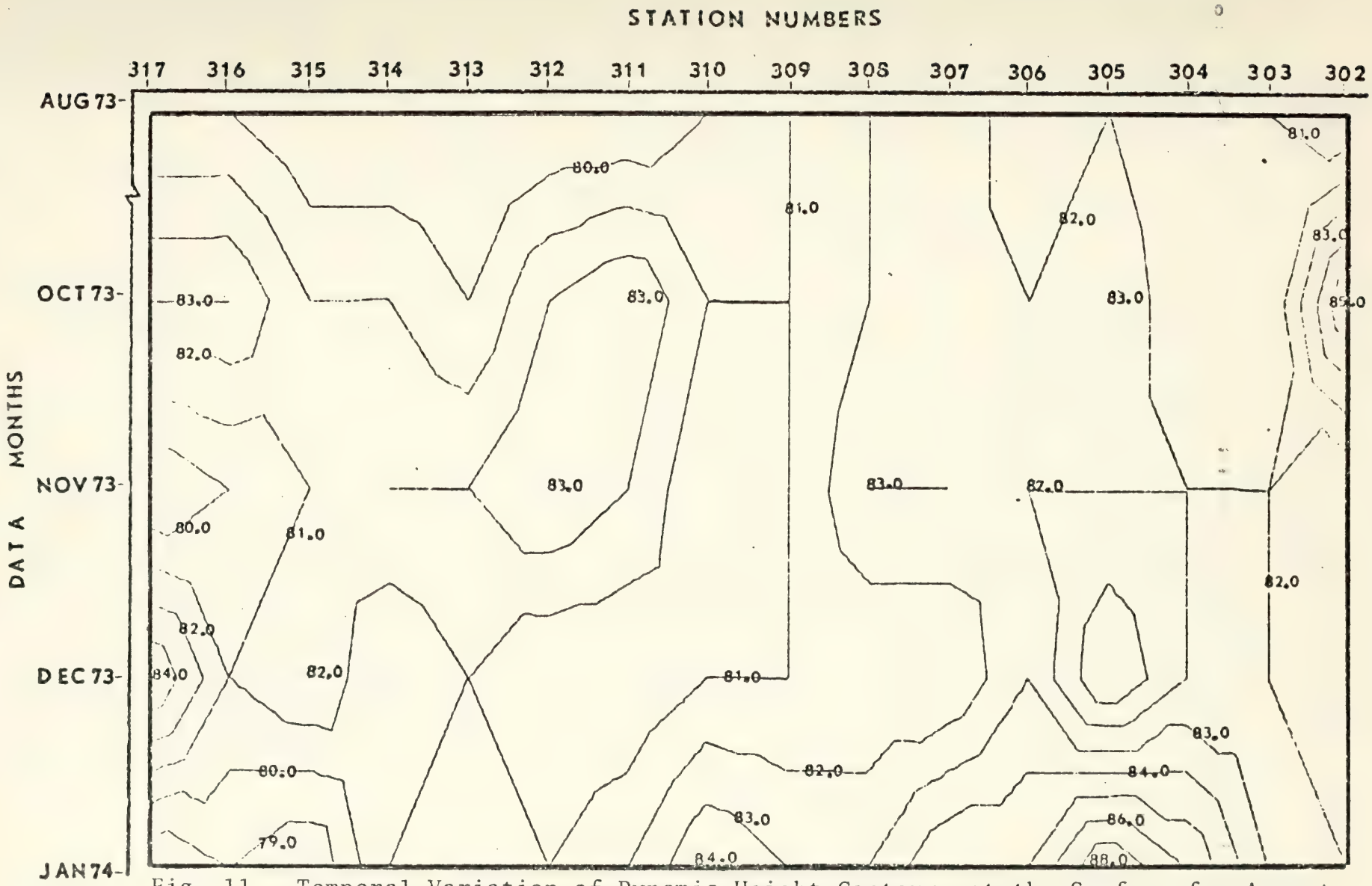


Fig. 11. Temporal Variation of Dynamic Height Contours at the Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

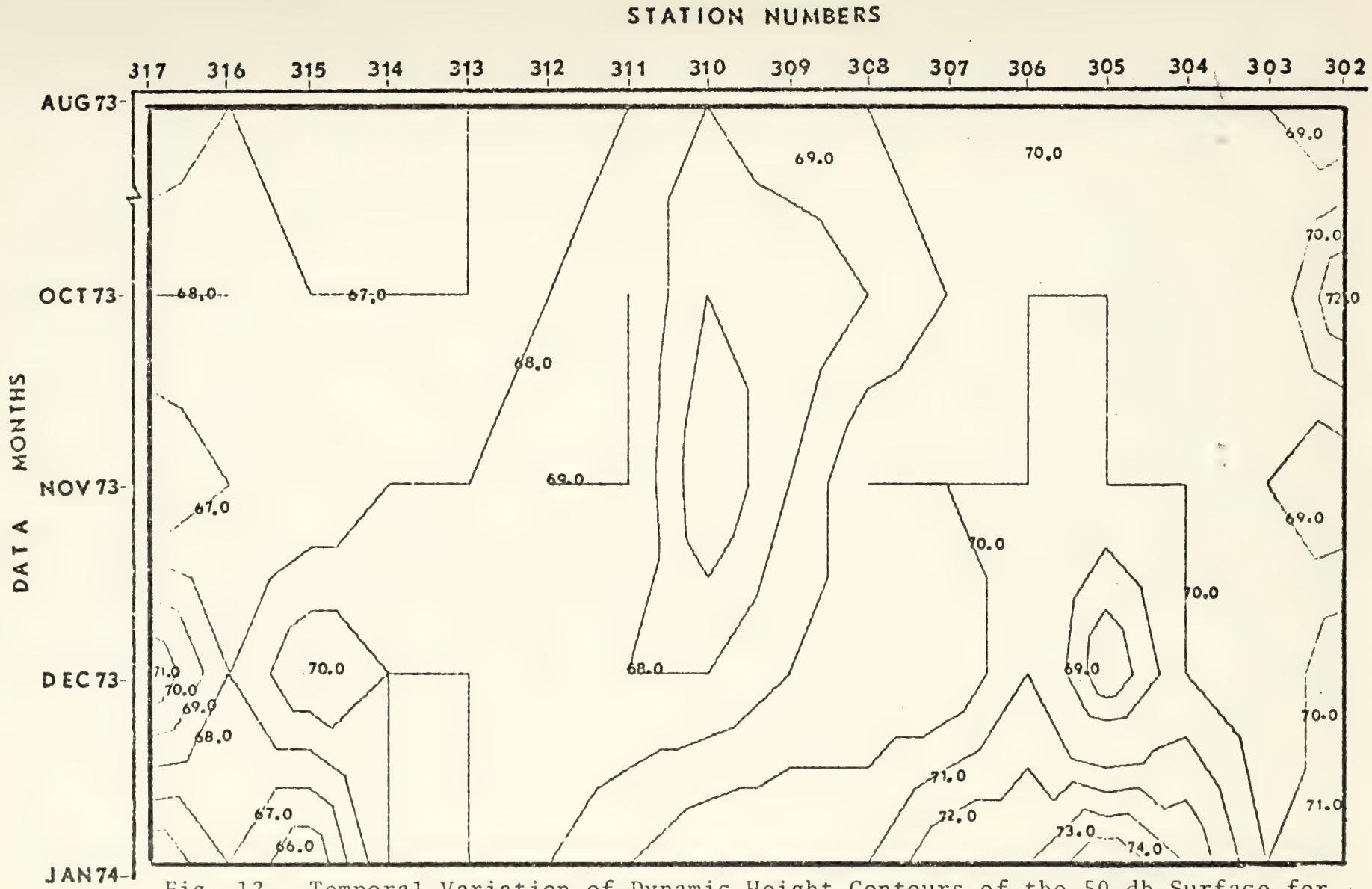


Fig. 12. Temporal Variation of Dynamic Height Contours of the 50 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

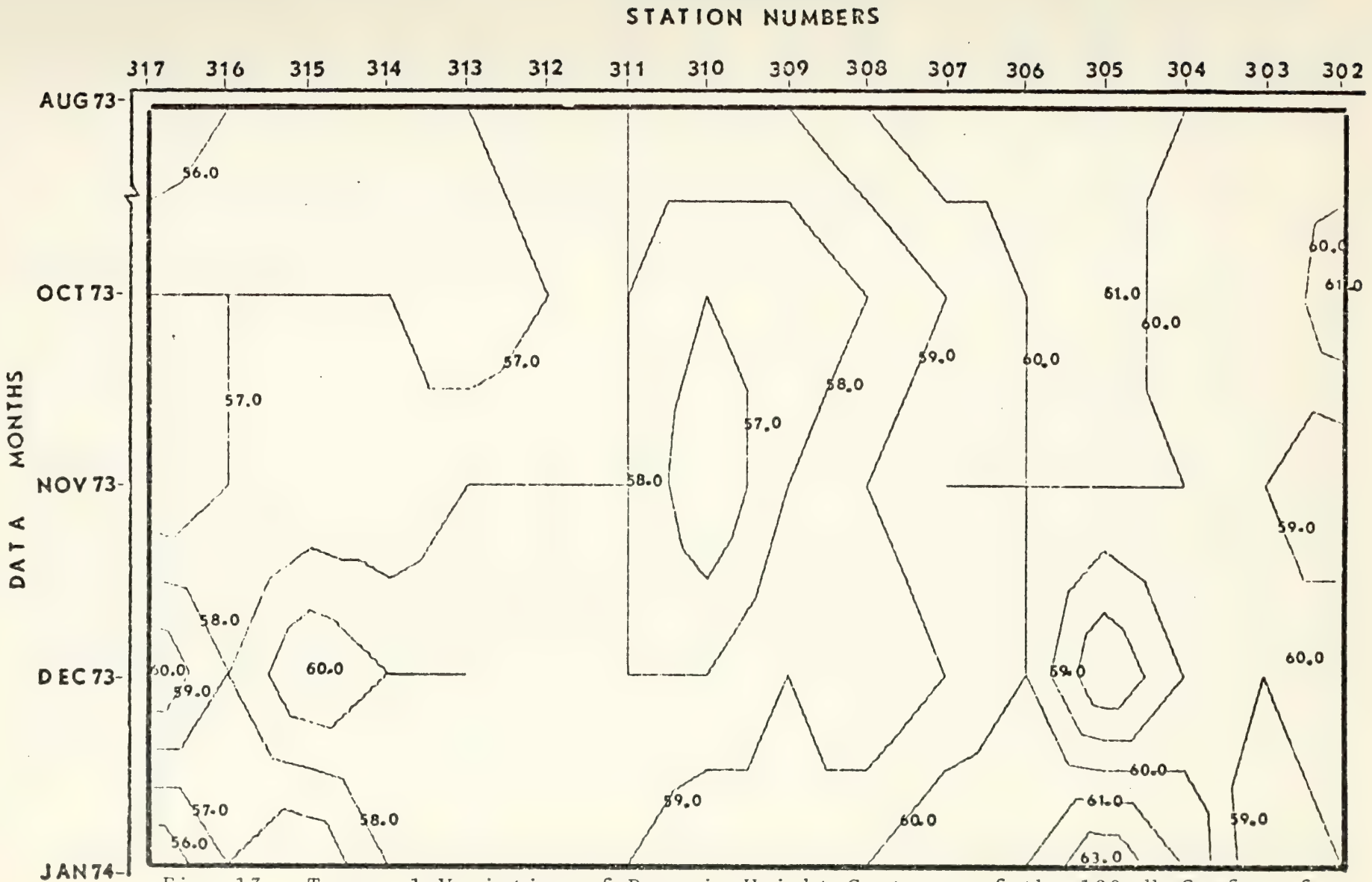


Fig. 13. Temporal Variation of Dynamic Height Contours of the 100 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

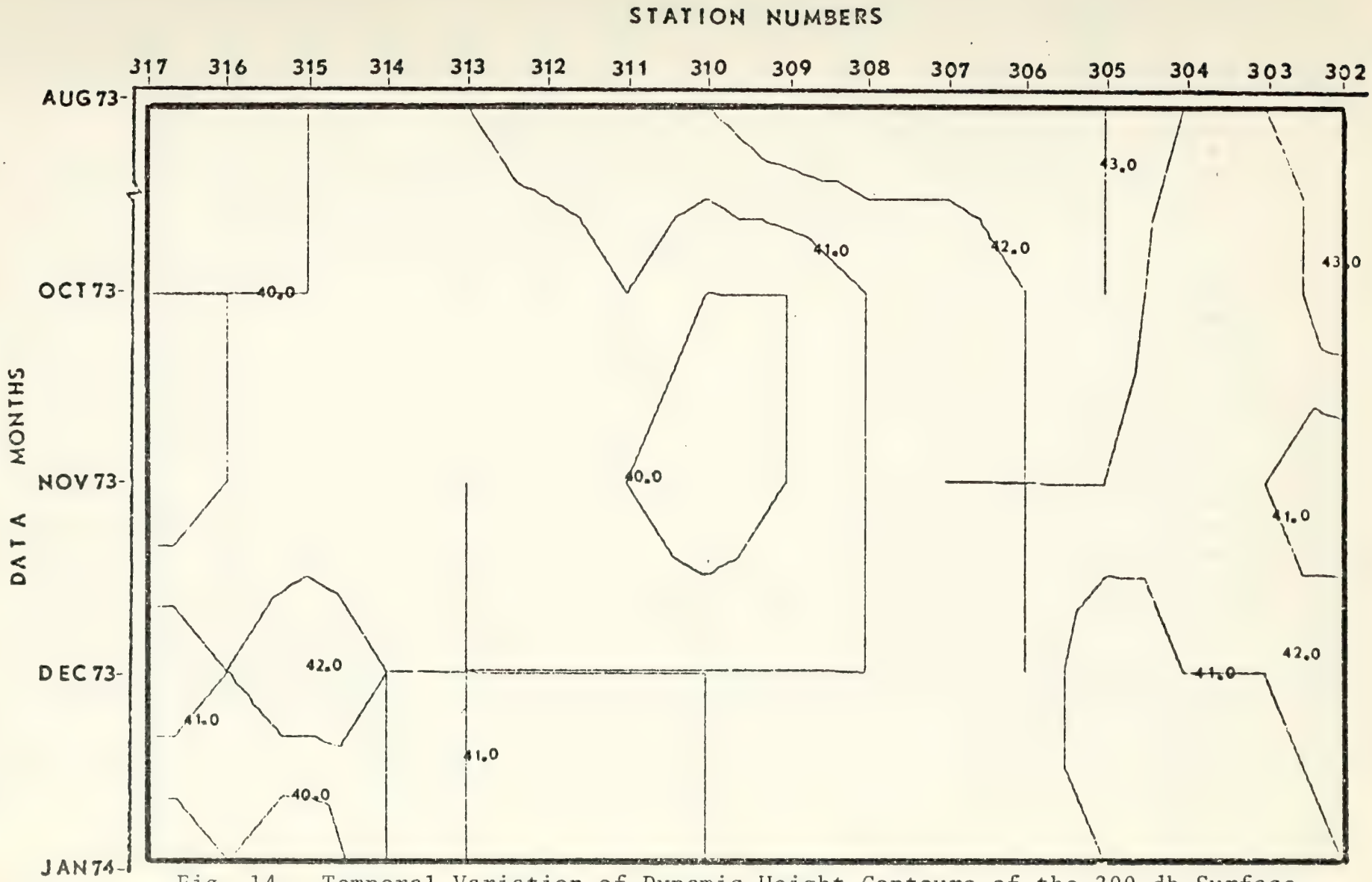


Fig. 14. Temporal Variation of Dynamic Height Contours of the 200 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

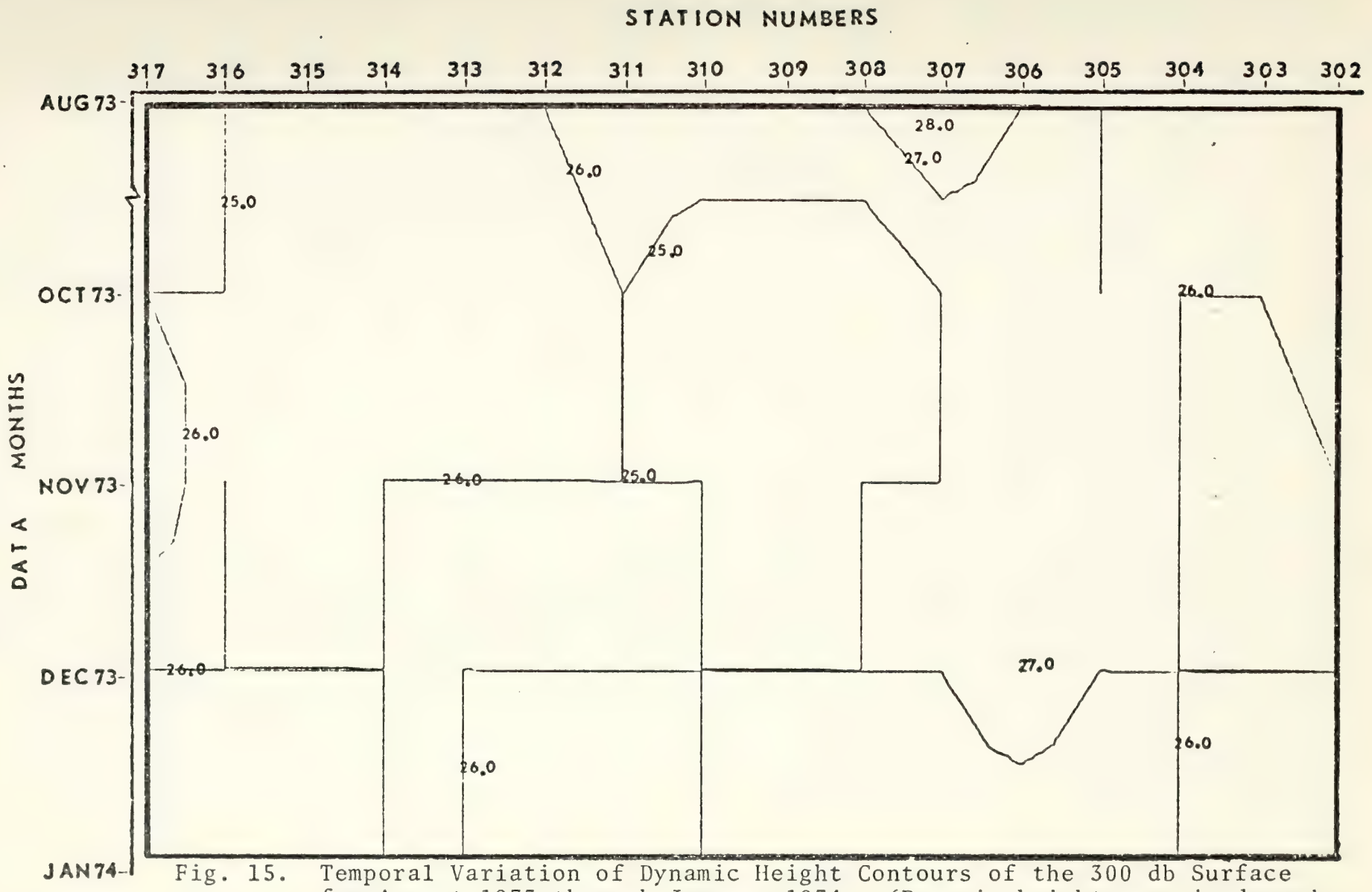


Fig. 15. Temporal Variation of Dynamic Height Contours of the 300 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

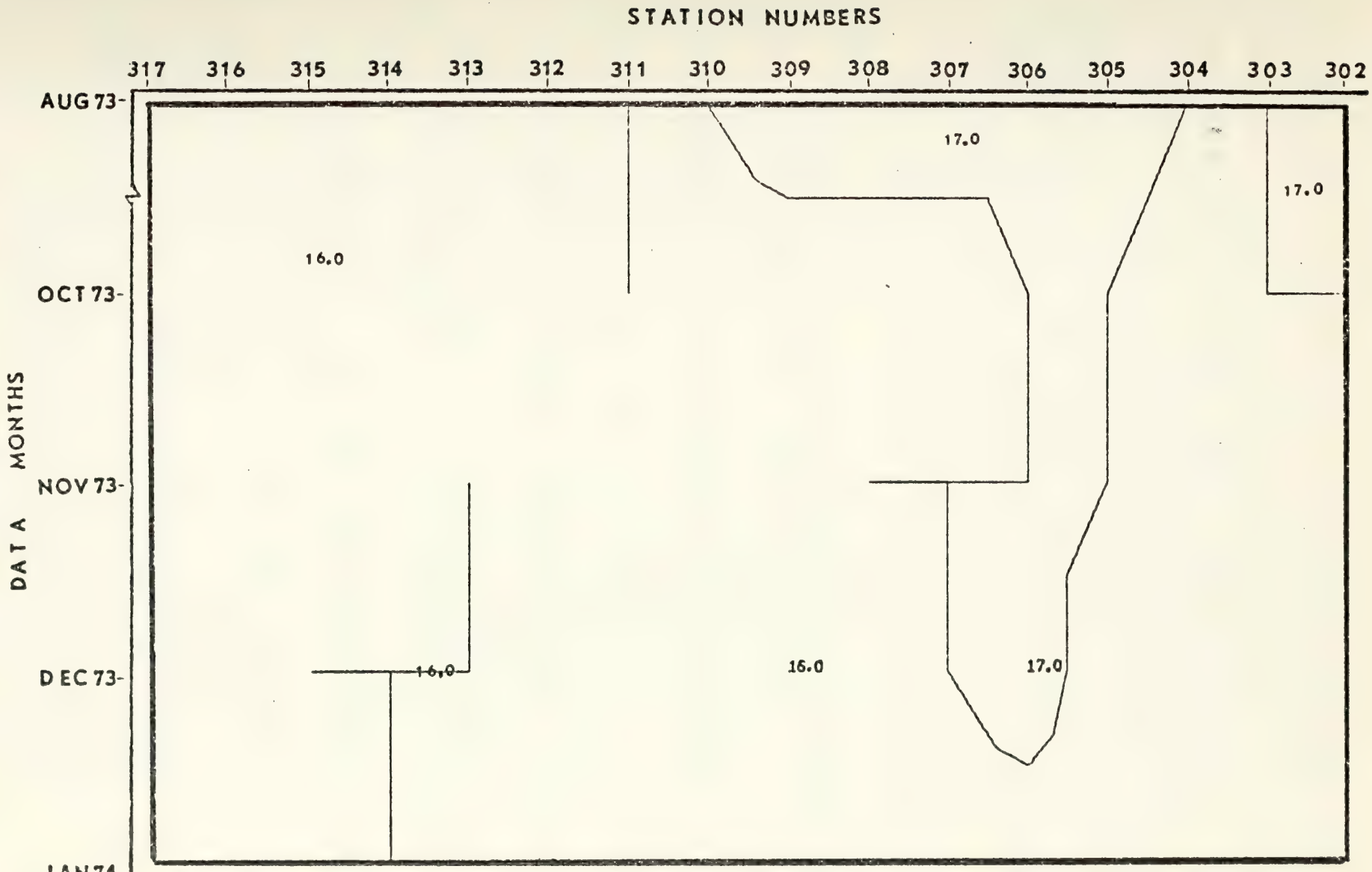


Fig. 16. Temporal Variation of Dynamic Height Contours of the 375 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

height values based on 16 STD stations per data cruise month, depict the temporal variation of geostrophic flow at several depths for only the period, August 1973 through January 1974. Figures 17 through 21, which were constructed from dynamic height values based on either STD or Nansen data at three data stations per data cruise month, depict the temporal variation of geostrophic flow at several depths over the period January 1974 through August 1974.

The prominent features depicted in figures 11 through 16 are,

(1) The general surface flow pattern over the time period, August 1973 through January 1974, is very similar to those found at 50 m, 100 m, 200 m and 300 m.

(2) The geostrophic flow is more intense during the period November 1973 through January 1974 than during August through October 1973 in the upper 200 meters of depth.

(3) The poleward flow appears to shift to the west with time.

(4) The equatorward flow, east of station number 309, during December 1973 through January 1974 appears to be more intense in the upper 200 meters than the poleward flow.

(5) A reversal in the flow direction is depicted in the vicinity of station 305 such that the predominant flow east of station 305 is equatorward, and poleward west of the station.

(6) A narrow band of poleward flow located between stations 306 and 309 is apparent throughout the period, and from the surface to 375 m.

Now consider figures 17 through 21. Obviously, the small scale structure revealed in figures 11 through 16 cannot be seen in figures 17 through 21 due to the data observation grid size. However, there are a few features that are apparent.

(1) The flow is more intense during January, June and August 1974 than during February, March and July 1974.

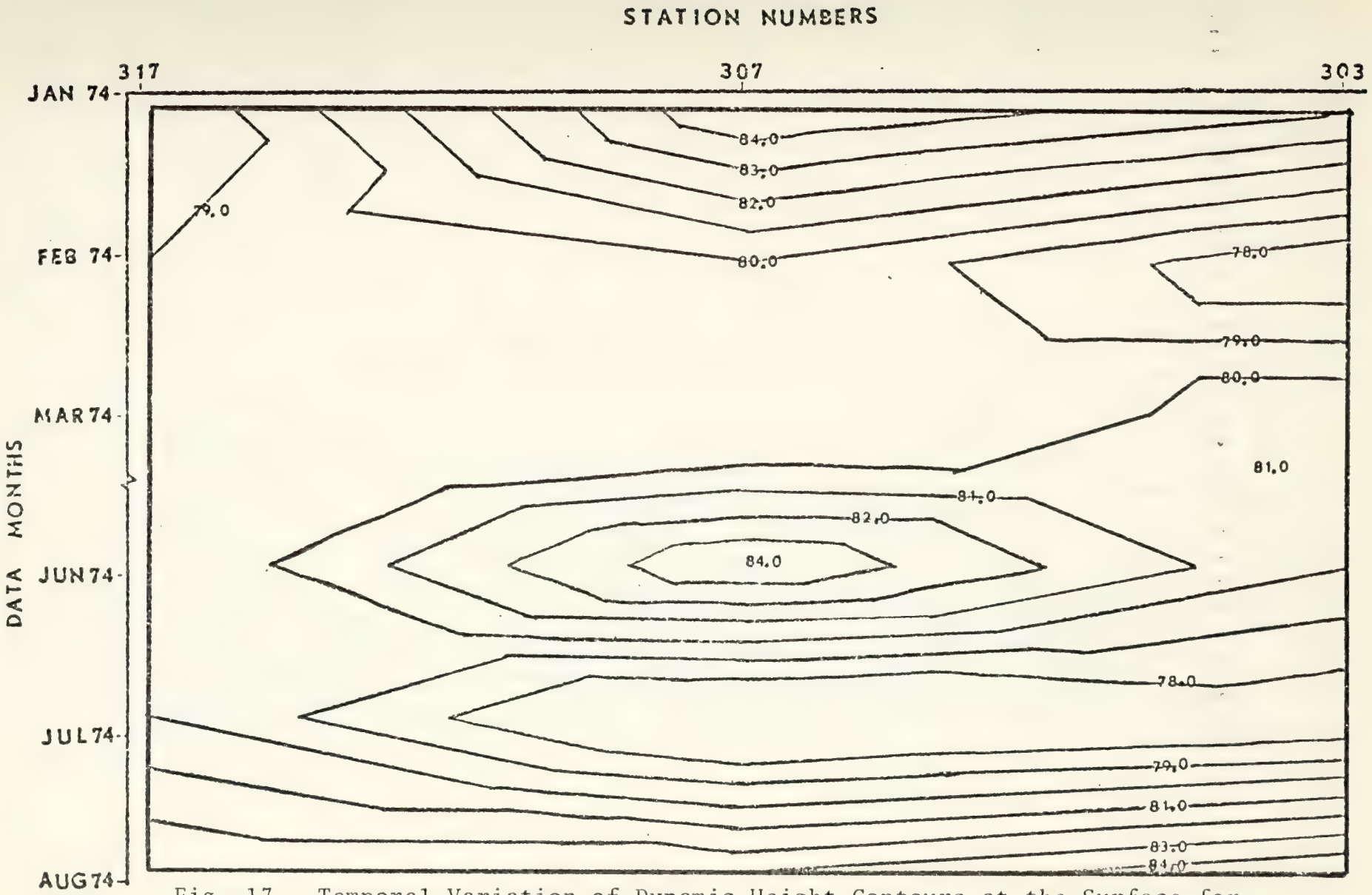


Fig. 17. Temporal Variation of Dynamic Height Contours at the Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

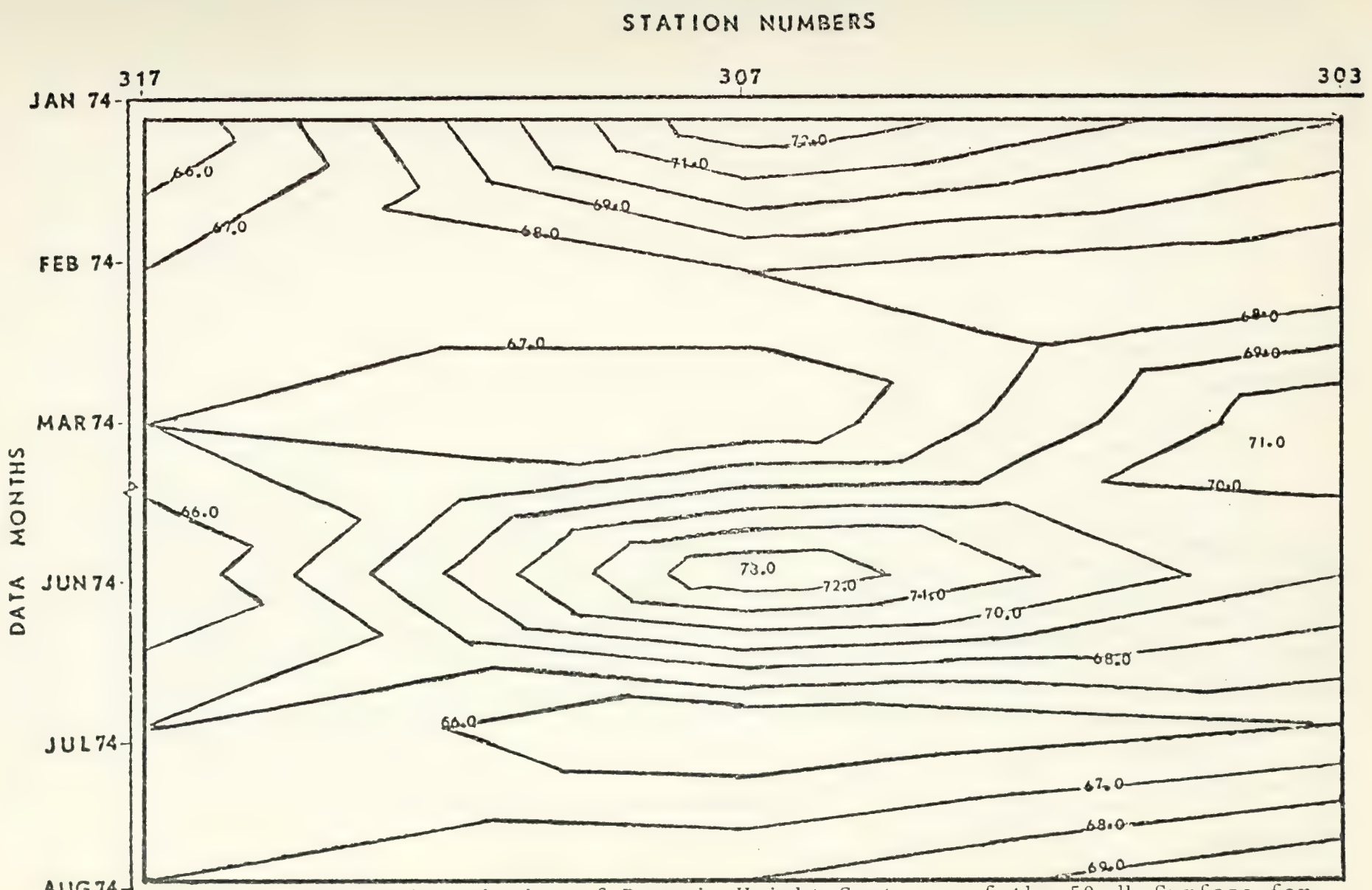


Fig. 18. Temporal Variation of Dynamic Height Contours of the 50 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

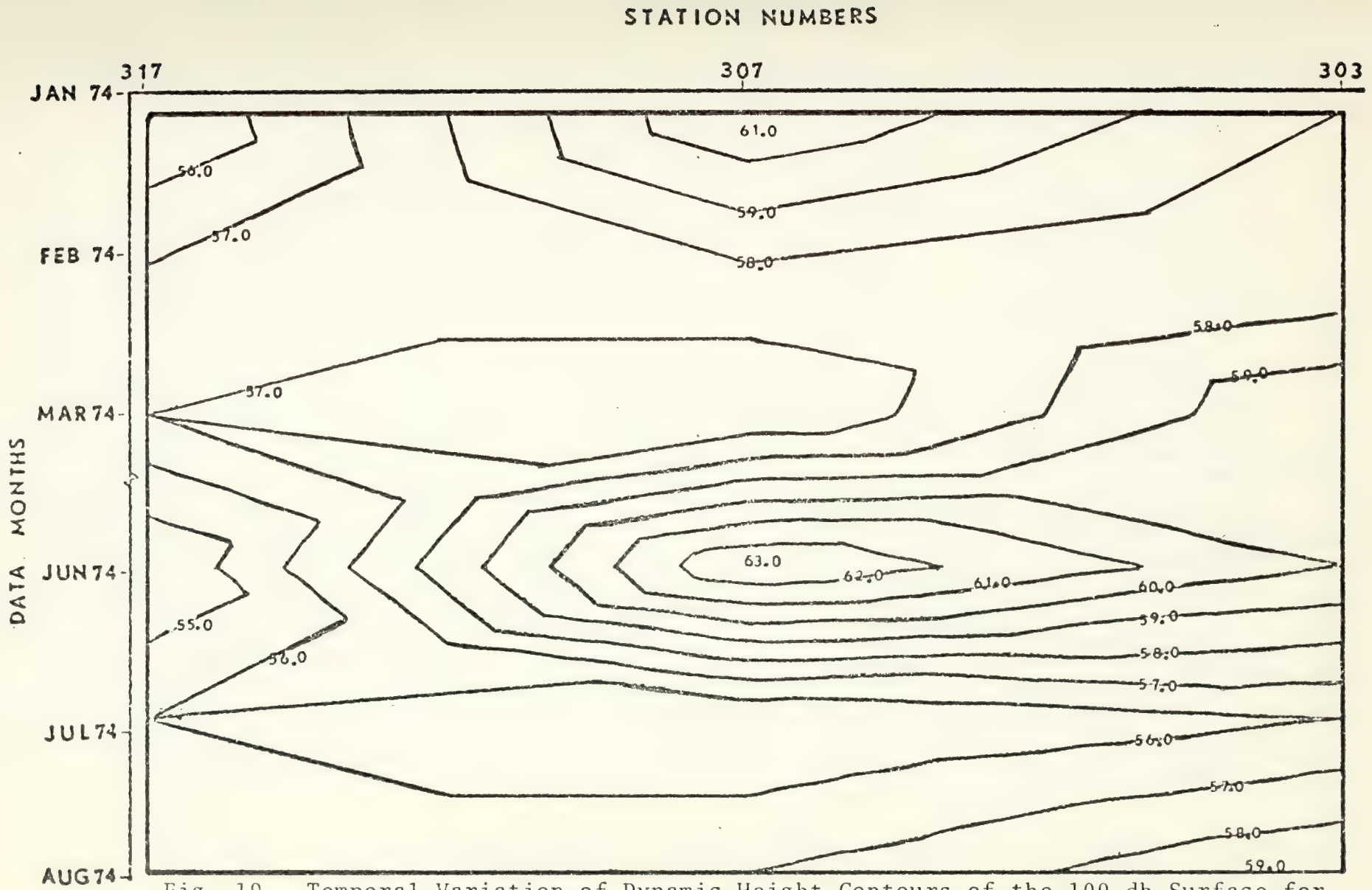


Fig. 19. Temporal Variation of Dynamic Height Contours of the 100 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

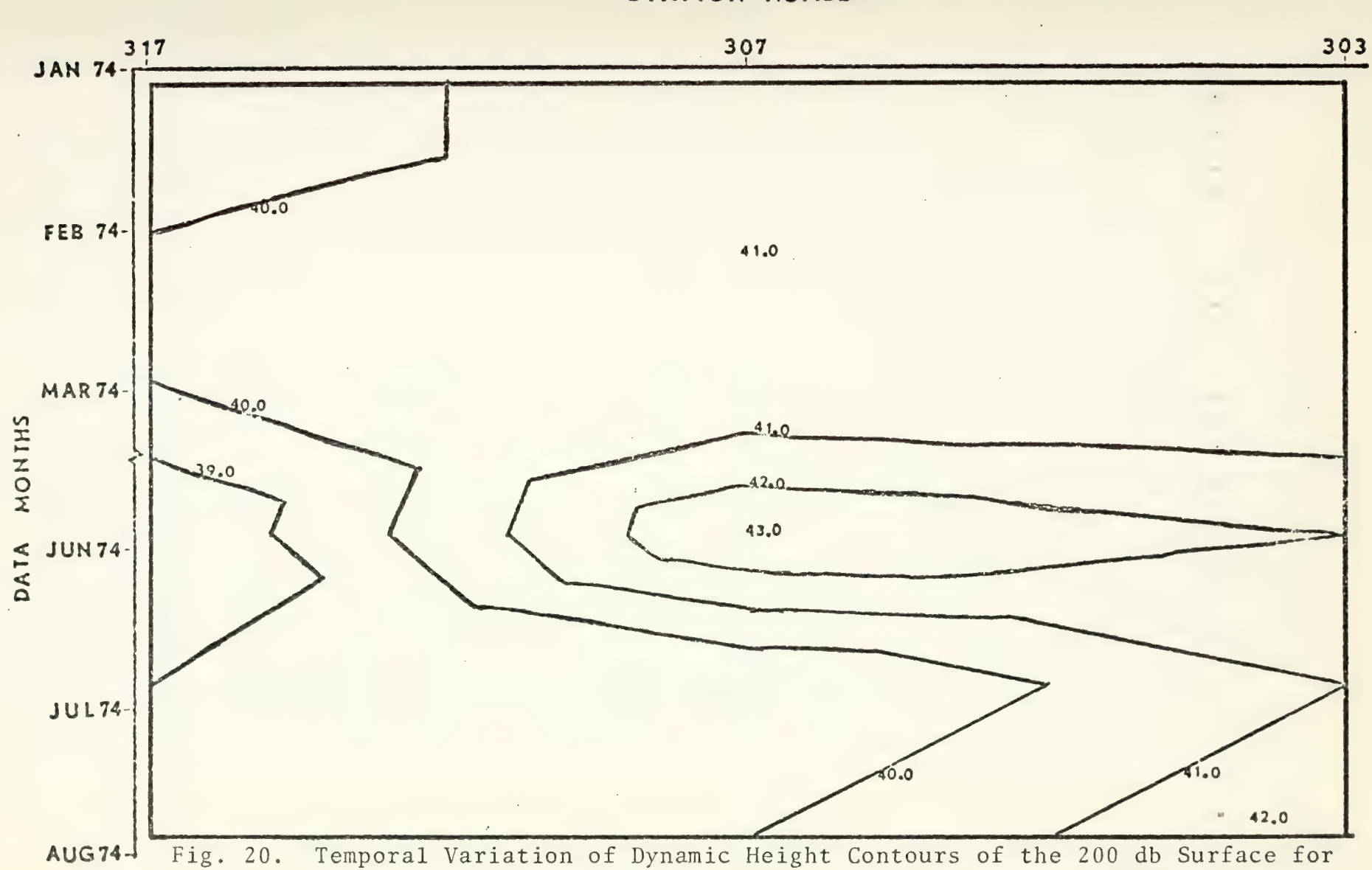


Fig. 20. Temporal Variation of Dynamic Height Contours of the 200 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

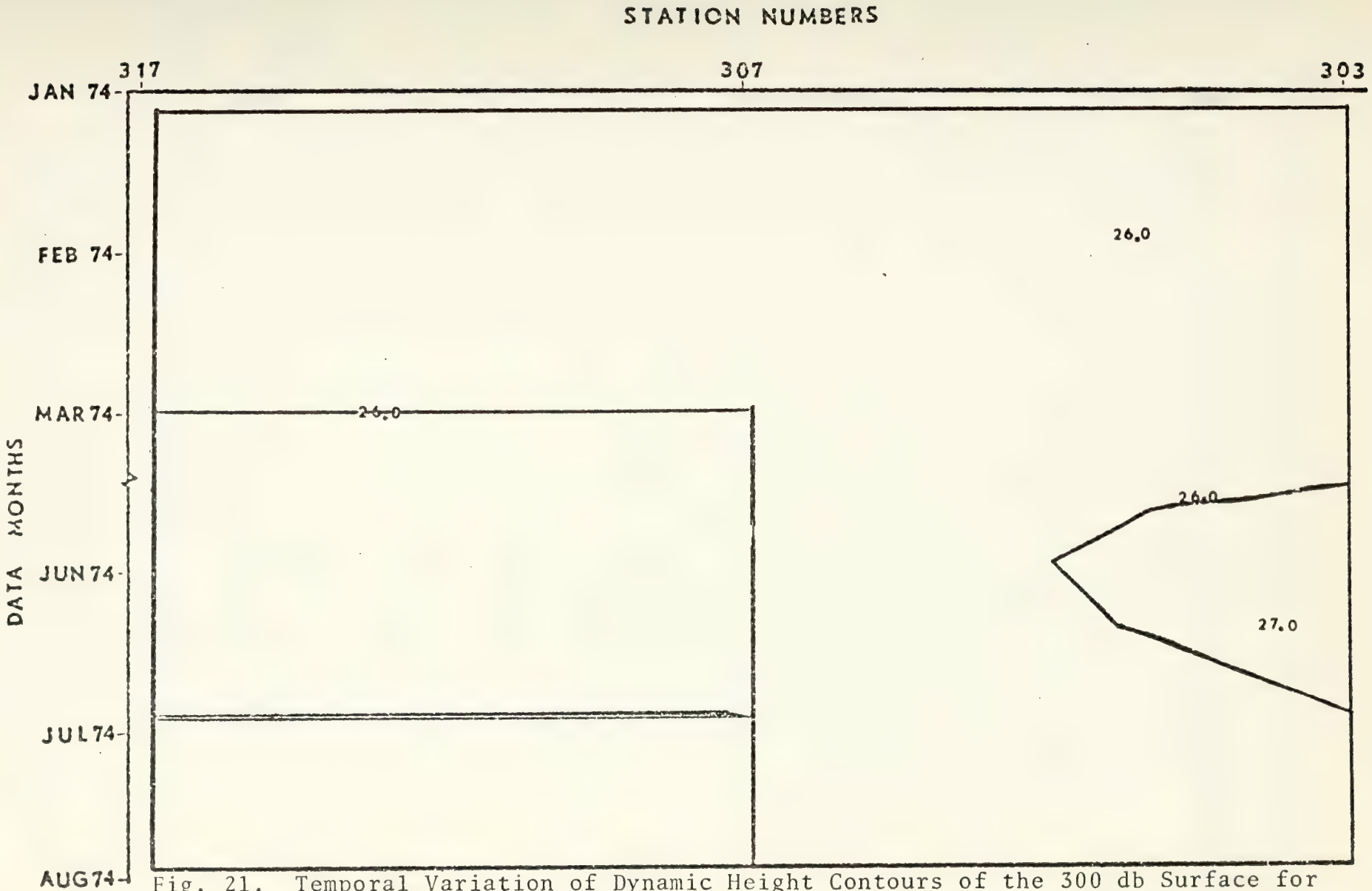


Fig. 21. Temporal Variation of Dynamic Height Contours of the 300 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)

(2) A reversal in flow direction in the upper 200 meters occurs between June and July 1974.

(3) Current speeds at depth during January through August 1974 are significantly less than speeds at depth during August 1973 through January 1974.

D. GEOSTROPHIC CURRENTS AND SALT TRANSPORT

The vertical structure of geostrophic flow normal to a section at latitude 36^{o} 40'N with respect to the 500 db surface is depicted by monthly vertical cross sections of geostrophic salt transport contours. Initially, both vertical cross sections of salt transport contours, and geostrophic isotachs were constructed. However, with exception of magnitude and dimensional units, the isotachs were nearly identical to the vertical contours of geostrophic salt transport. Consequently, the figures depicting vertical cross sections of geostrophic isotachs have been omitted in favor of the salt transport contours. Accordingly, figures 22 through 33 depict the vertical structure of geostrophic salt transport during August 1973 through February 1974, and June through August 1974.

In the discussion and presentation of results in this section, each monthly vertical cross section will be discussed in terms of its general flow and transport characteristics, its direction and current speeds, and the nature of the water.

To clarify the information presented in figures 22 through 33, the following comments are made,

(1) The dimensional units of salt transport are ($gm/sec\text{-}cm^2$).

(2) Generally, every other contour has been labeled according to its particular transport value. Negative values (hatched area) indicate transport to the north, and positive values indicate transport to the south.

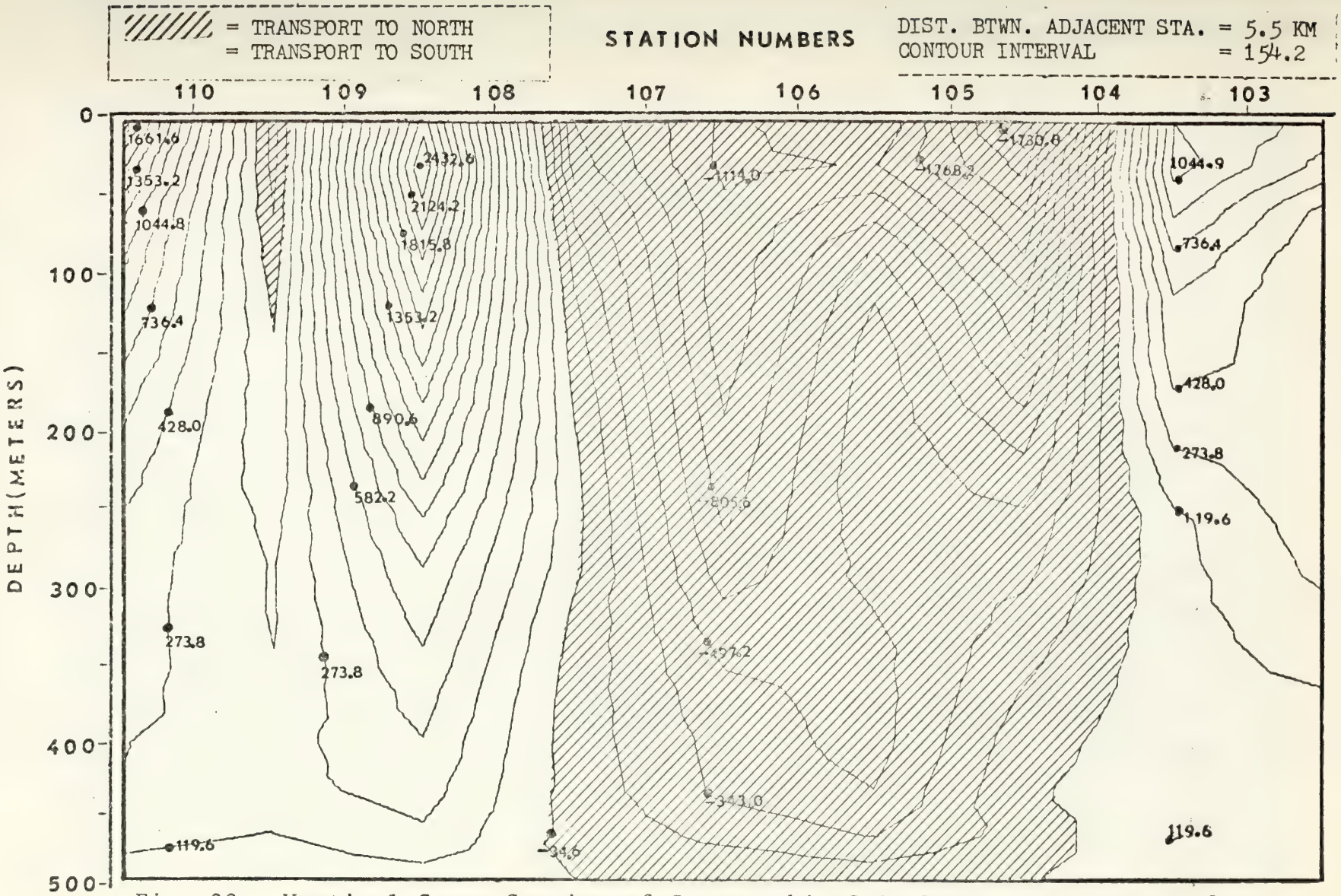


Fig. 22. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 111-102 during August 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

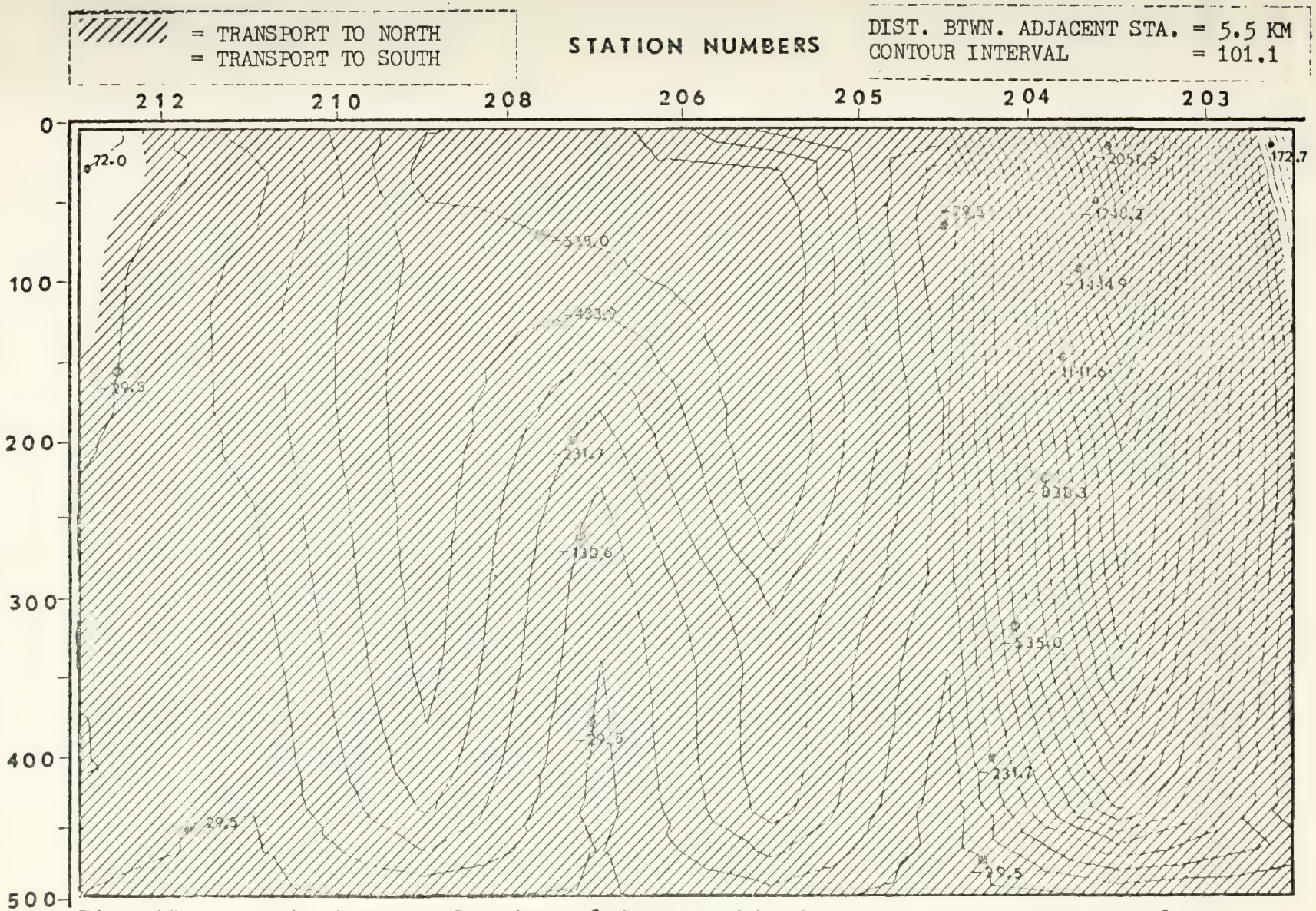


Fig. 23. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 214-202 during August 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

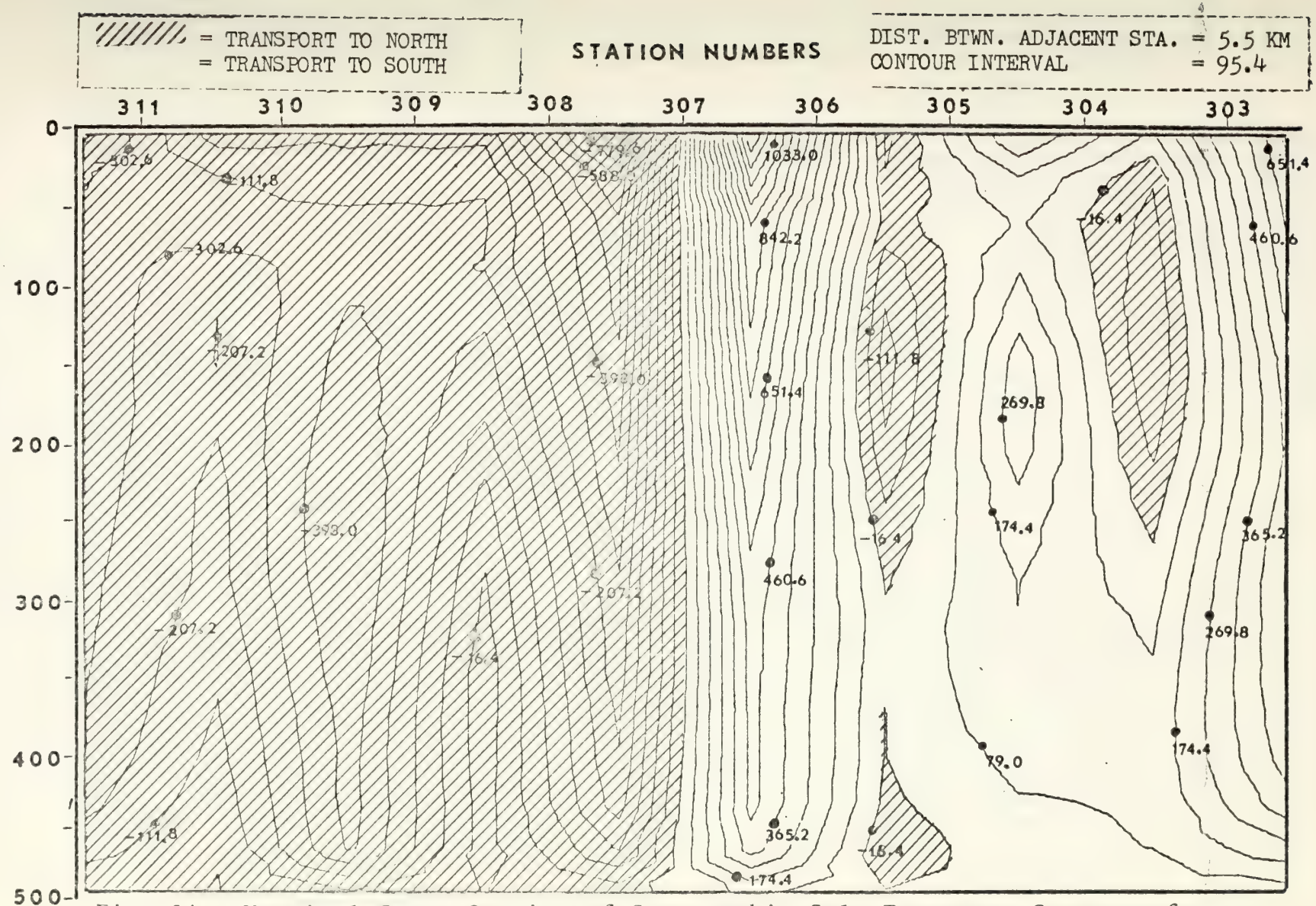
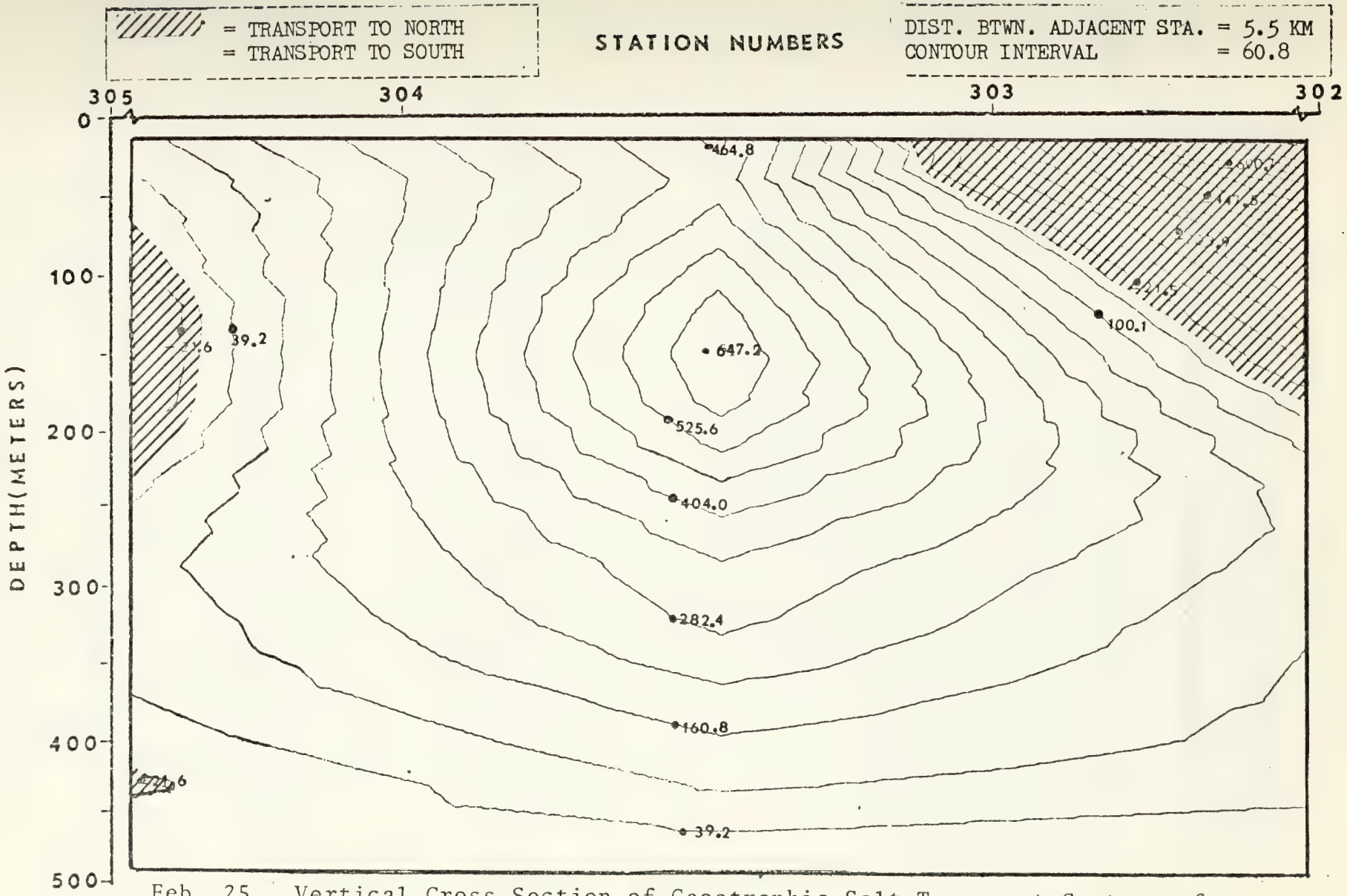


Fig. 24. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 315-302 during August 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)



Feb. 25. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during September 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

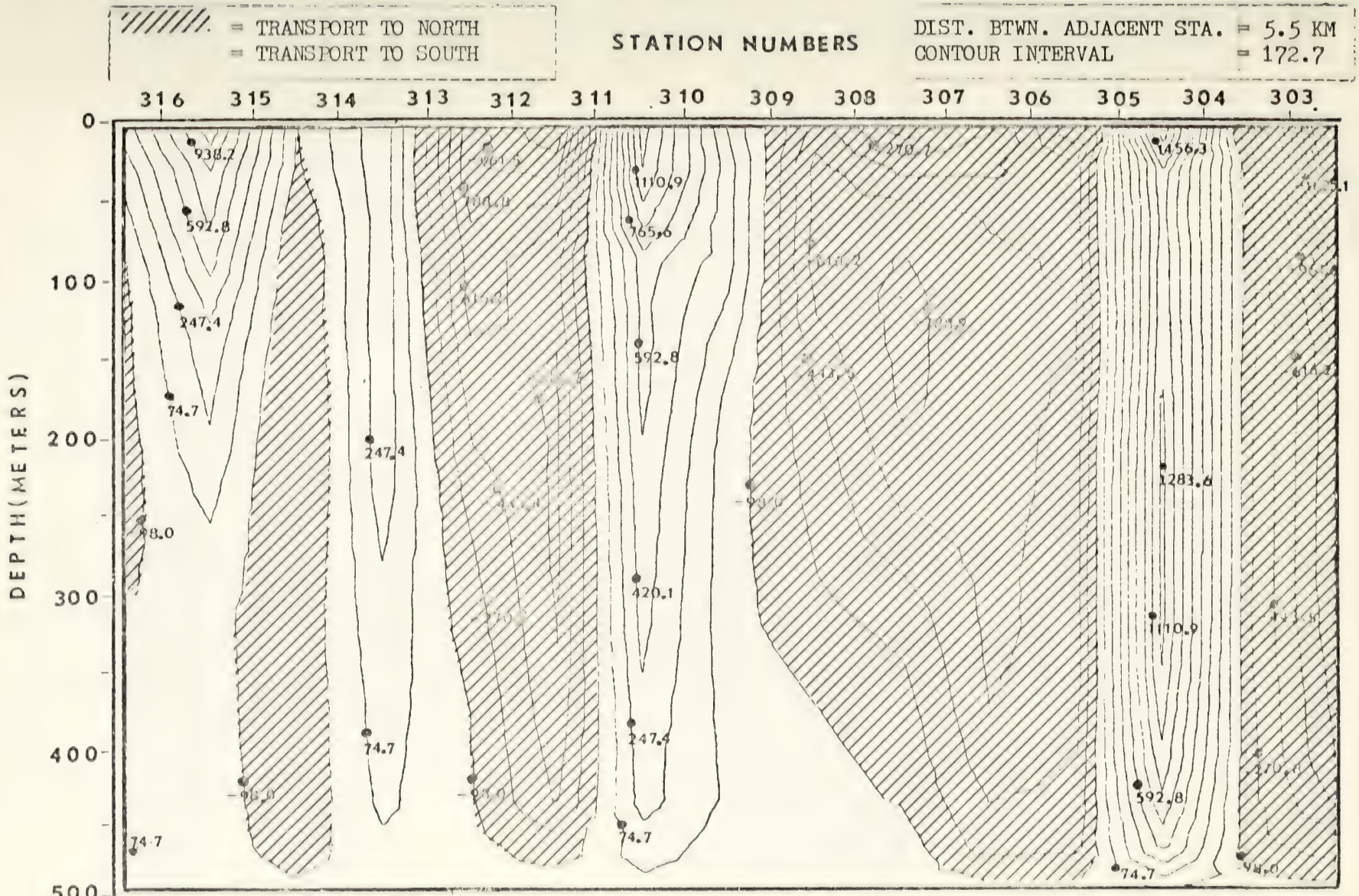


Fig. 26. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during October 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

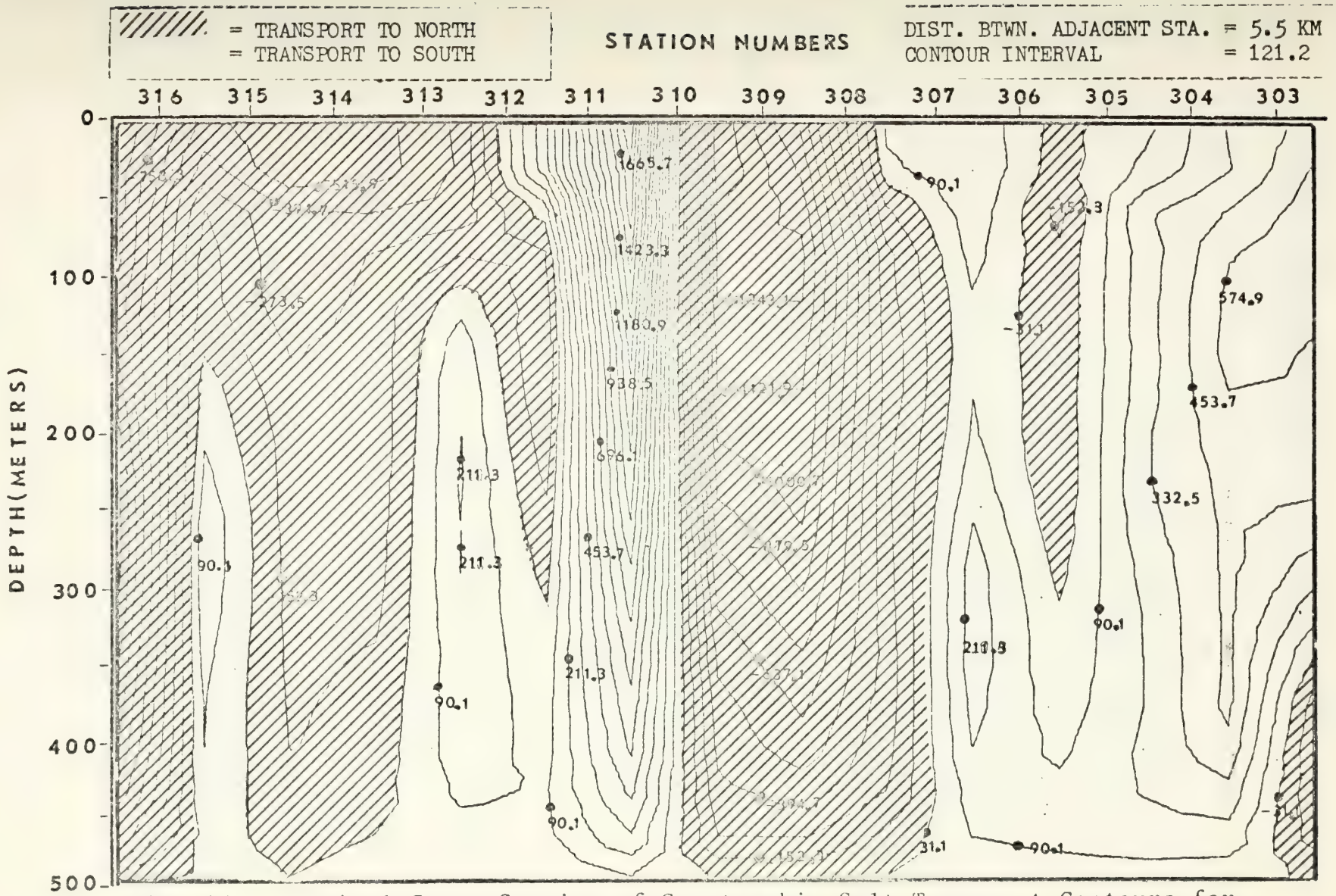


Fig. 27. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during November 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

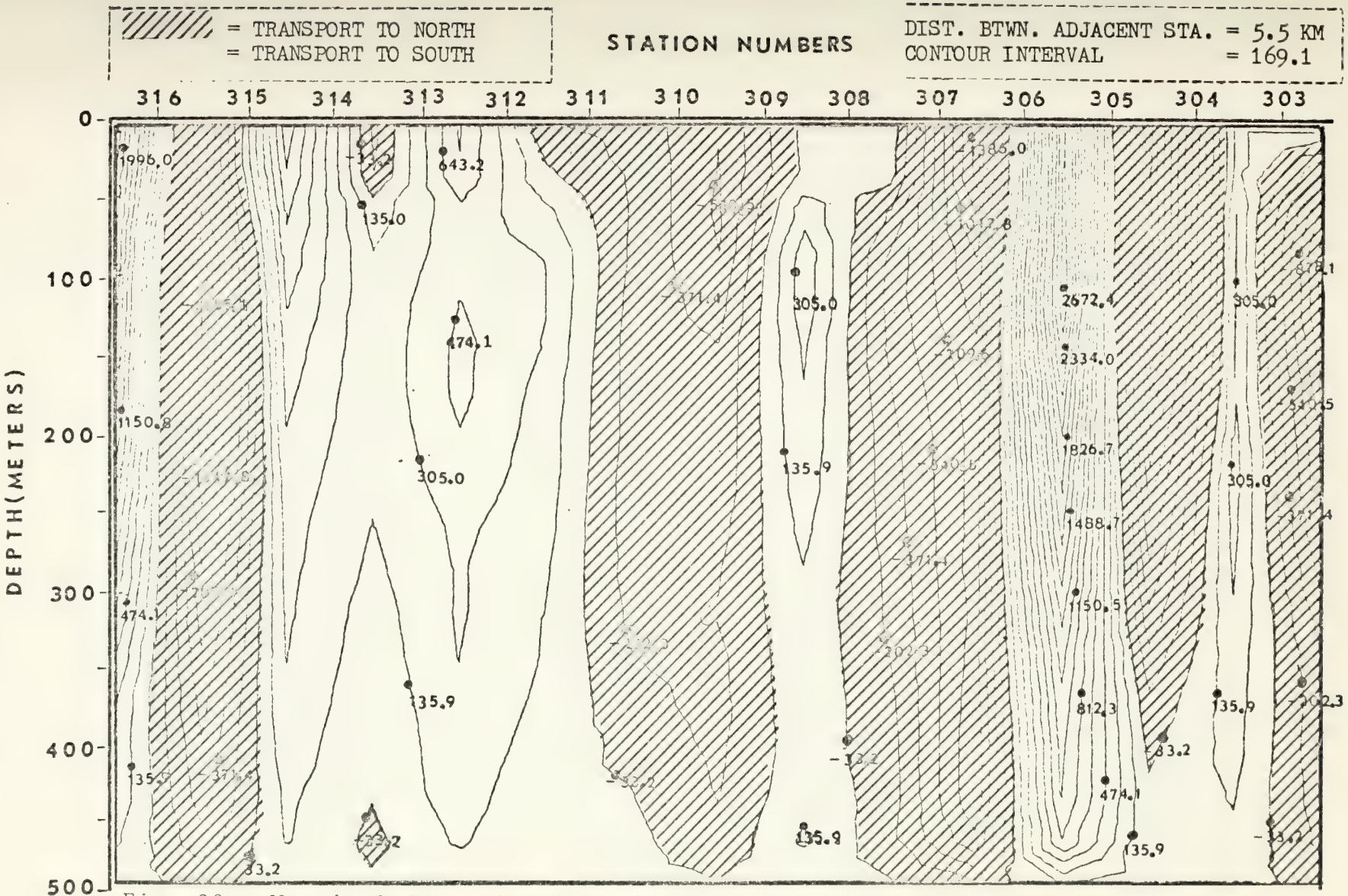


Fig. 28. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during December 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

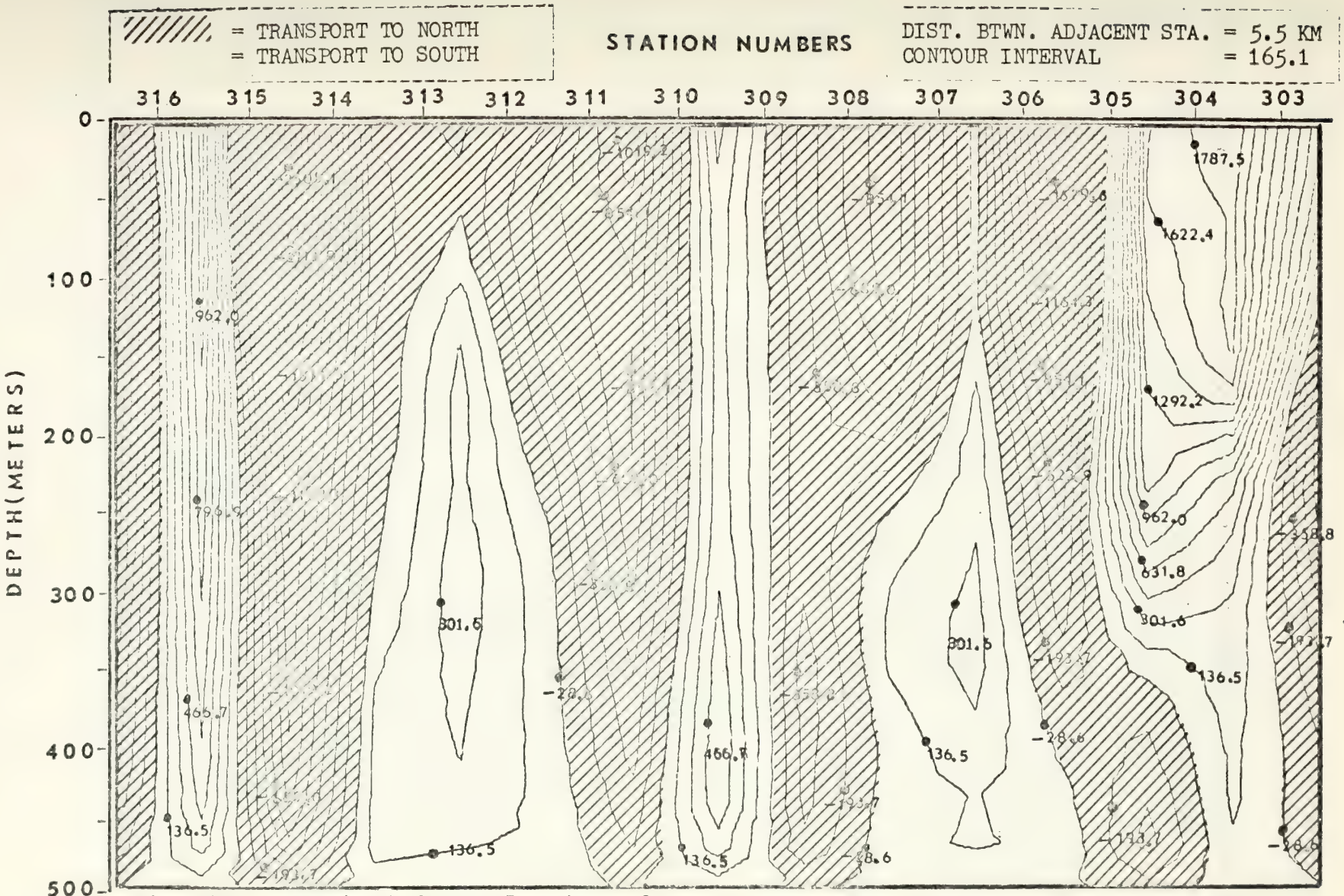


Fig. 29. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during January 1974. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

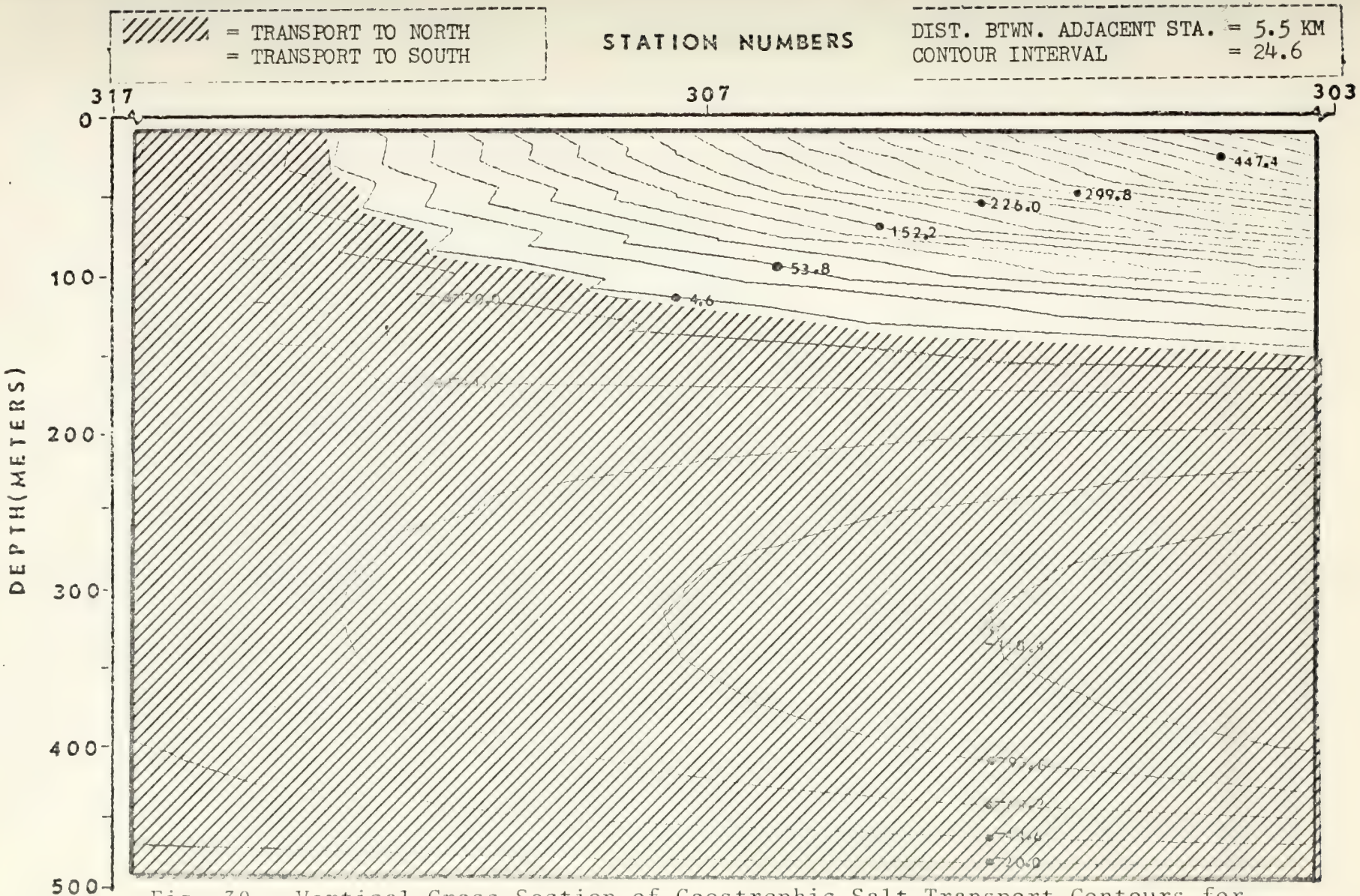


Fig. 30. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during February 1974. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

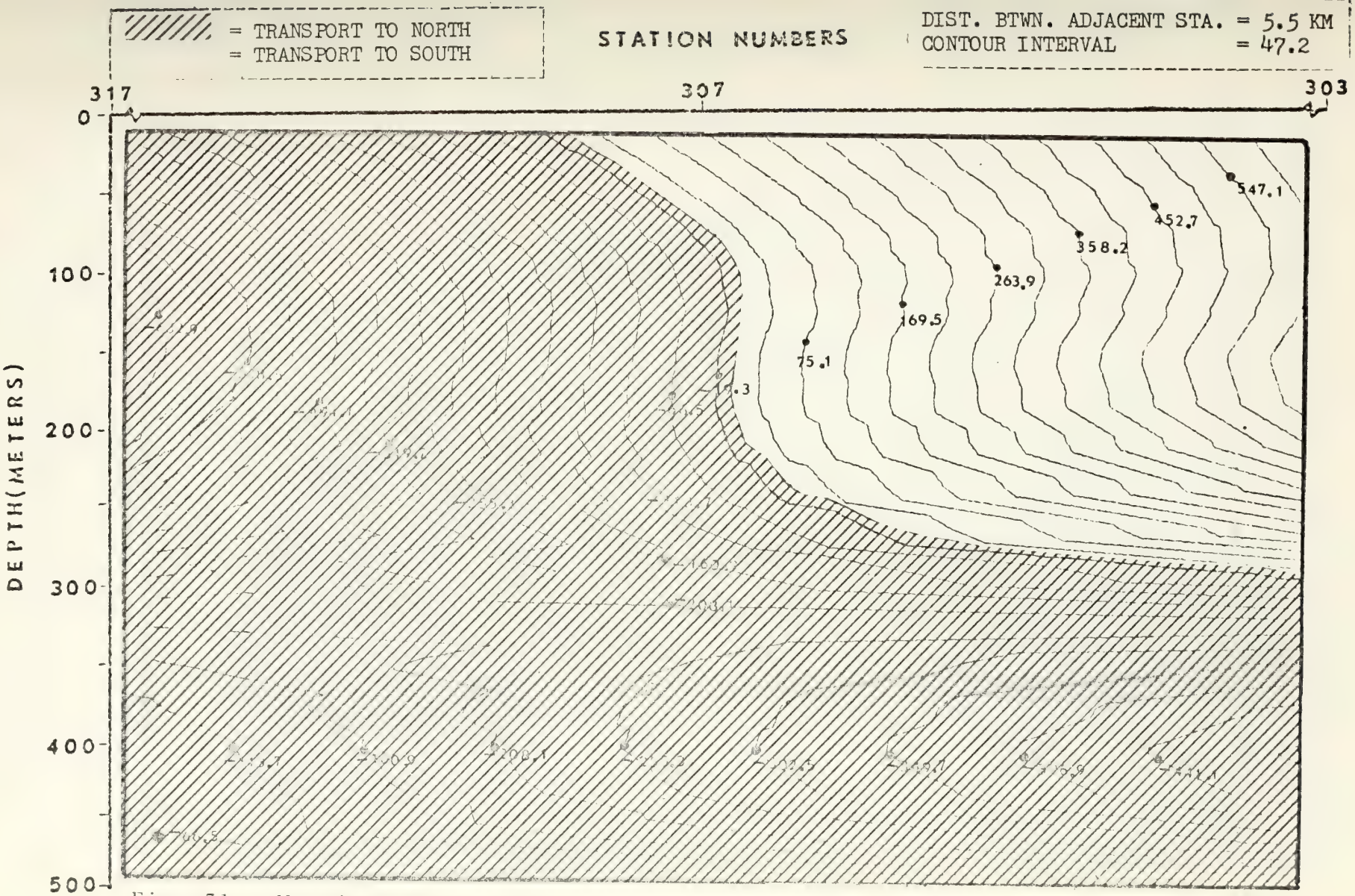


Fig. 31. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during June 1974. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

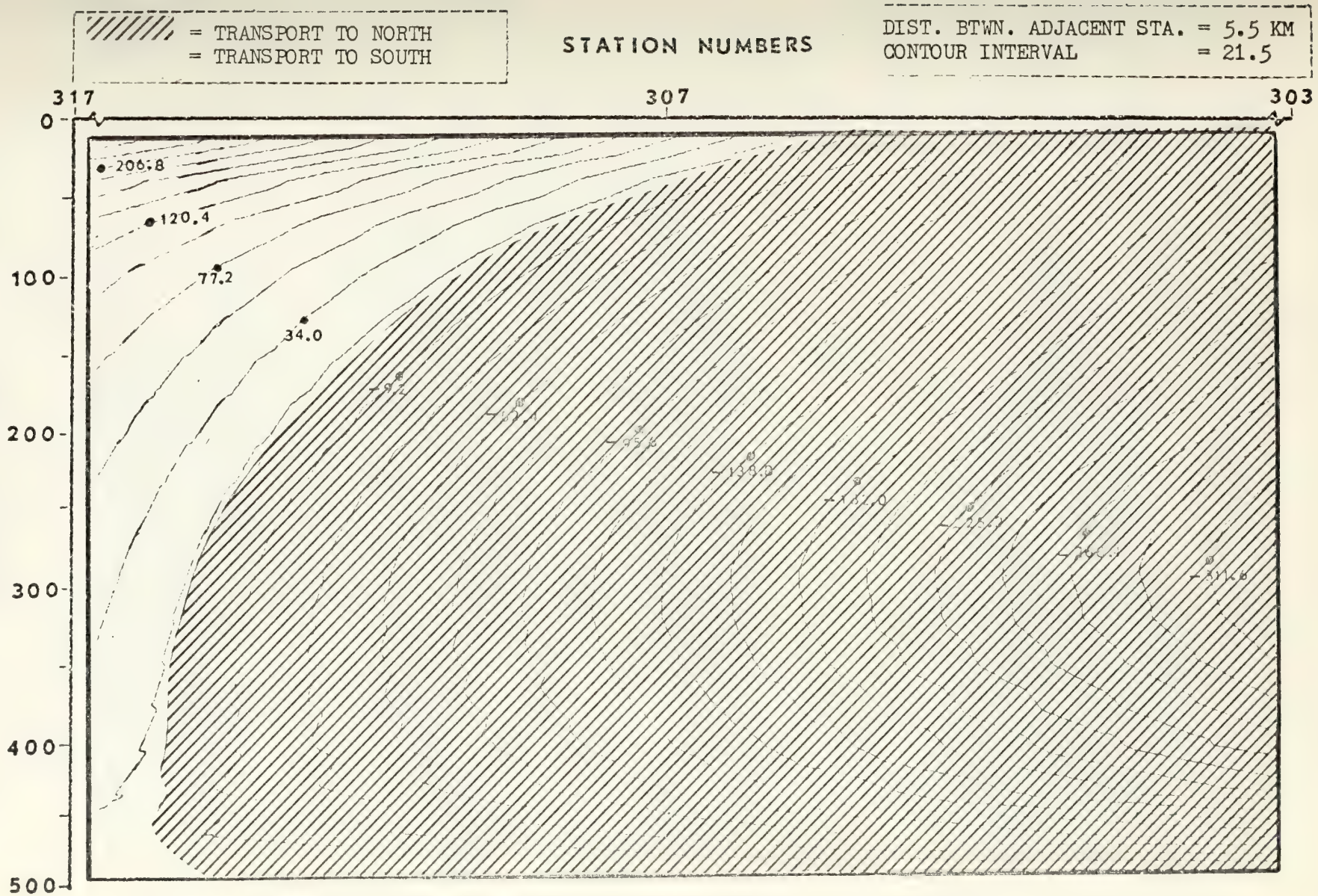


Fig. 32. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during July 1974. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

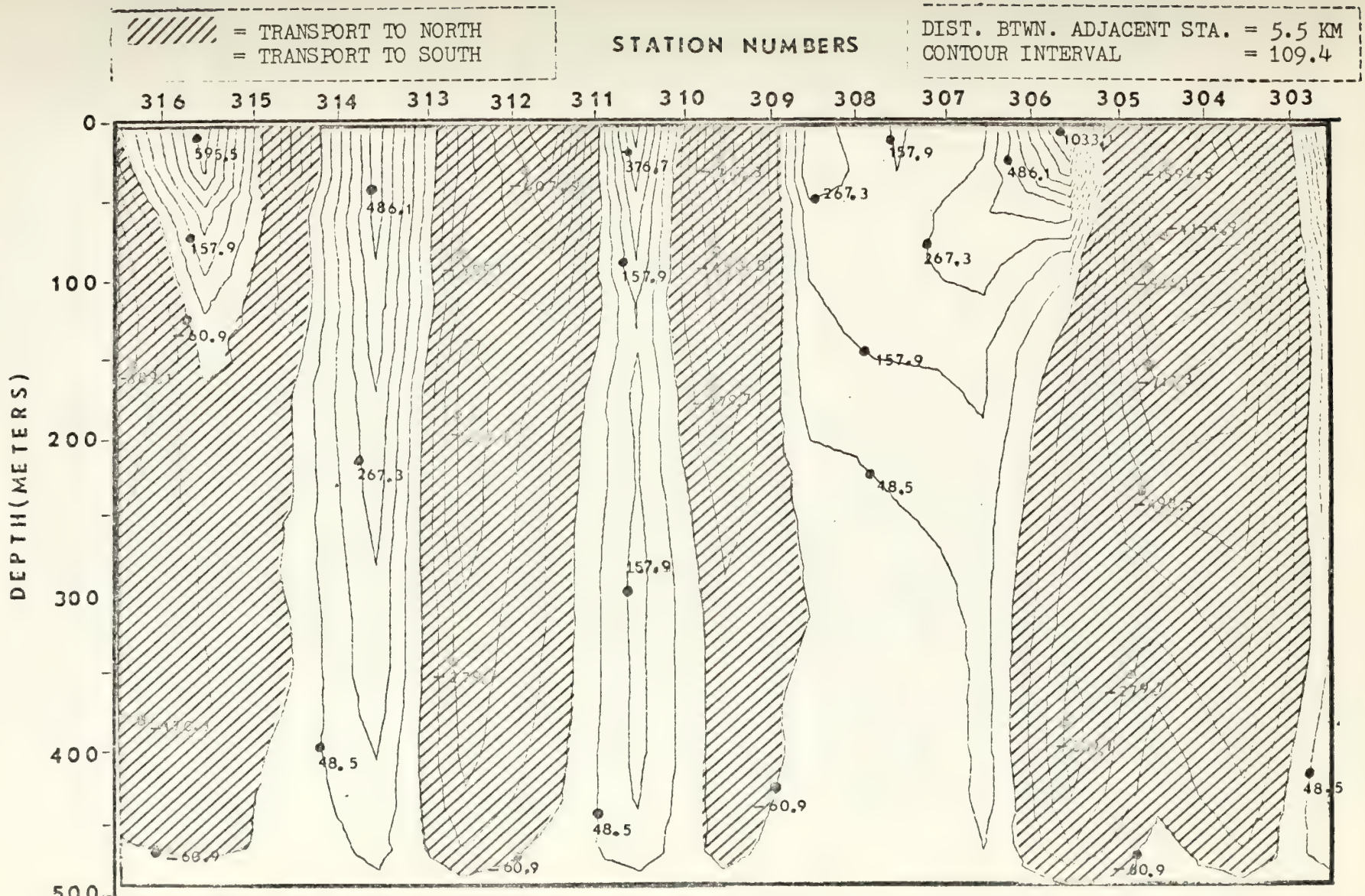


Fig. 33. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during August 1974. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)

(3) The exact contour interval is specified in units, (gm/sec-cm^2), at the upper right-hand corner of each figure.

(4) The black dots adjacent to the individual transport values identify the corresponding contour line.

(5) Distance between consecutively numbered adjacent stations is approximately 5.5 km. Note for figures 30 through 32, the distances between stations 303 and 307, and 307 and 317 are approximately 22 km and 55 km, respectively.

Consider the vertical structure of geostrophic flow during August 1973. Figures 22 through 24 depict the vertical structure of geostrophic salt transport contours during August 1973 for stations 111-102, 214-202 and 315-302, respectively. Examine, first, stations 111-102 along the 36^o 20' parallel of latitude depicted in figure 22. Poleward transport (shown by hatched area) located west of longitude 122^o 11'W is approximately 20 km in width and extends from the surface to 500 m. A maximum speed and salt transport of approximately 50 cm/sec and 1730 gm/sec-cm^2, respectively, are indicated at the surface between stations 104 and 105. However, current speeds and salt transport values range generally from 30 cm/sec and 1114 gm/sec-cm^2 at the surface to 20 cm/sec and 736 gm/sec-cm^2 at 300 m. To the west of the poleward flow, geostrophy indicates an intense equatorward jet (maximum speed 70 cm/sec) at about longitude 122^o 27'W. Farther west the flow is towards the equator with a maximum surface speed of 56 cm/sec decreasing with depth to less than 10 cm/sec at 300 m.

Figure 23 depicts the vertical structure in August 1973 along the 36^o 30'N parallel of latitude. Along the entire length of the station line, poleward transport is indicated

by geostrophy with a maximum surface speed of 62 cm/sec decreasing to 15 cm/sec at 300 m in the vicinity of longitude 122° 09'W. Farther to the west the poleward flow is characterized by speed and salt transport surface values of 15 cm/sec and 535.0 gm/sec-cm², respectively.

The vertical structure along the 36° 40'N parallel of latitude during August is depicted by figure 24. East of longitude 122° 22'W the flow is predominantly towards the equator while towards the west the flow is poleward. Maximum current speed and transport surface values are 40 cm/sec and 1320 gm/sec-cm², respectively, towards the equator. While the poleward flow to the west is approximately 35 cm/sec at the surface, it decreases to 10 cm/sec at 300 m.

There is some evidence that the equatorward and poleward jets indicated in figures 22 and 23 are realistic; the author refers to a concurrent study, examining the water mass characteristics by Blumberg [1975]. His findings indicate a sharp front-like water mass boundary along both jet axes. These water mass boundaries are indicated by large angles between isopycnal and isothermal surfaces from the near-surface to approximately 450 m. Additionally, there is theoretical basis for an equatorward jet in a dynamical model for eastern boundary flows [McNider and O'Brien, 1973], and drogue drifts [Wickham, 1975] in the same area also show large shears. These factors tend to support the view that the flow details are real; it should be noted, however, that mass distributions consistent with the calculated dynamic heights could also be produced by internal waves of amplitude 50 m.

Now consider the relation between the flow and structure. The current patterns indicated by both drogues and geostrophy tend to confirm an analysis of the structure which has elongated filaments of southern water flowing poleward in narrow bands, particularly near the coast [Wickham, 1975]. Specifically, drogue paths at 200 m in August 1973 tend to show this tendency.

The vertical structure of geostrophic flow in September 1973 is depicted in figure 25. Unfortunately, only the far eastern sector, stations 302 to 305, of the investigation area is shown. As in the preceding month, the flow in the eastern sector is predominantly to the south. There are maximum speed and salt transports of approximately 20 cm/sec and 650 gm/sec-cm^2 at 150 m. Towards the coastline there is a poleward flow contained in the upper 150 meters with a maximum current speed of 30 cm/sec at the surface.

Figure 26 depicts the vertical structure of geostrophic flow in October 1973. The flow structure consists of elements of several tens of kilometers in width extending from the surface to 500 m. Poleward flow dominates the first 20 km west of station 305, longitude 122^o 15'W, with some indications that it is an undercurrent, since a maximum current speed and transport of approximately 20 cm/sec and 790 gm/sec-cm^2, respectively, lie below the surface from 100 to 200 meters. To the west of station 309 the flow appears to be alternating narrow bands of equatorward and poleward flow. The elements are typically 10 km wide, and extend from the surface to 500 m.

The vertical structure of geostrophic flow in November 1973 is depicted in figure 27. The flow is generally poleward

west of station 307 with a maximum salt transport of approximately 1370 gm/sec-cm^2, and current speed of approximately 40 cm/sec at the surface. Upon comparing October and November 1973 vertical cross sections, there are indications that the equatorward flow east of station 307 is becoming weaker with current speeds less than 10 cm/sec at the surface. This is evidence that the onset of the Davidson Current period has taken place. The equatorward jet (maximum speed 55 cm/sec) axis located between stations 310 and 311 (longitude 122^o 33'W) lies in a region with "northern" characteristics; i.e., it is anomalously cold for its density [Blumberg, 1975].

Figure 28 depicts the vertical structure of geostrophic flow in December 1973. The flow is predominantly poleward east of station 311 with the exception of a narrow-banded intense equator jet (maximum speed 77 cm/sec) located between stations 305 and 306 (longitude 122^o 15'W). In this case, the intense equatorward jet axis does not clearly correspond to water of "northern' characteristics. West of station 311 the flow is generally more to the south but weaker than the narrow band of poleward flow. Maximum current speed and salt transport for the narrow band of poleward flow are 30 cm/sec and 1555 gm/sec-cm^2. Whereas, with few exceptions, equatorward current speeds of less than 20 cm/sec characterize the flow within the upper 300 m.

The vertical structure of geostrophic flow in January 1974 is depicted in figure 29. Typical of the Davidson Current period, the general flow is towards the north. Poleward current

speeds vary from approximately 10 to 30 cm/sec in the upper 300 m. Two narrow jets, poleward and equatorward, have axes which are not unambiguously related to the water mass structure. The poleward jet reaches a maximum speed of 75 cm/sec while the equatorward jet reaches a maximum of 58 cm/sec. West of station 306 the flow structure is complex with regions of weak narrow band equatorward flow interspersed among a predominantly poleward flow.

Figure 30 depicts the flow in February 1974. The geostrophic salt transport contours shown in figure 30 as well as figures 31 and 32 are based on data obtained from three Nansen data stations. Consequently, the small-scale detail seen in previous figures is not recognizable. However, the general flow structure between January and February are similar. From concurrent analysis of water mass characteristics during this month there are indications that upwelling has begun along the coast. Figure 30 also tends to corroborate the onset of upwelling in that the poleward California countercurrent has disappeared, for the most part, above 200 m due to the onset of north-northwesterly winds, and is now in evidence as an undercurrent with a maximum current speed (this being a mean over 20 km) of approximately 4 cm/sec at 300 m. The flow above 100 m is predominantly equatorward with a maximum speed and salt transport of approximately 16 cm/sec and 520 gm/sec-cm^2, respectively.

The vertical structure of geostrophic flow in June 1974 is depicted in figure 31. The California undercurrent is well

defined and confined below 200 m in the eastern part of the investigation area during June. Maximum current speed (14 cm/sec) and salt transport (490 gm/sec-cm^2) occur at 400 m. Farther west the undercurrent tends to surface as evidenced by the maximum speed and transport values occurring between 100 and 200 meters.

Figure 32 depicts the vertical flow structure in July 1974. The undercurrent has pushed closer to the coast, and shows signs of its ascent to the surface. The maximum poleward current speed (9 cm/sec) and salt transport (312 gm/sec-cm^2) are located at 300 m. Concurrent analyses of the water mass characteristics indicate that upwelling was not present along the station line at 36^o 40'N but was possibly present along the 36^o 30'N parallel line. This is not surprising since upwelling tends to be a localized phenomenon. The flow depicted in figure 32 appears to agree with the seasonal period of the California Current System.

The vertical structure of geostrophic flow in August 1974 is depicted in figure 33. The ascending undercurrent depicted in figure 32 has now surfaced with a maximum poleward current speed and salt transport of 53 cm/sec and 1810 gm/sec-cm^2, respectively, at the surface. The major northward flow between stations 303 and 306 coincides with southern water in a separate analysis [Blumberg, 1975]. Typical of the California Current during transition to the oceanic period, the flow is becoming more equatorward. However, west of station 309 the flow is apparently complex and characterized by narrow bands (less than 10 km wide) of weak poleward and equatorward flow.

From figures 22 through 33, it is apparent that the flow and structure in this area of the California Current System are highly complex. The vertical structure, in many cases, is characterized by what appears to be narrow bands of flow less than 10 km in width and by water mass elements of similar scale. Accordingly, only in surveys with sampling grid lengths less than 10 km could the complex structure and flow be realistically depicted. Of course, there still remains the question whether the results depicted here by geostrophy are correct in regards to the small-scale features. However, a sampling grid length of this order in the construction of a data base, in addition to extensive independent measurements of the current system, seems to be required if the behavior of the southern water and its associated current system are to be described.

V. SUMMARY AND CONCLUSIONS

A. GENERAL

The oceanic region just west of the continental shelf off Monterey Bay was examined in detail during the period August 1973 through August 1974. Observations were made on a horizontal grid much finer than is traditionally used in oceanographic surveys in order to permit horizontal definition of narrow bands of flow, and a continuous STD profiler was used to provide high density vertical sampling. Accordingly, the analyses of the data base over the 13-month period provided a description of the mesoscale components of the apparent geostrophic flow and its temporal and spatial variability in the California Current System. Some of the more interesting features of the flow and its structure with depth are provided below.

B. PATTERNS OF CURRENT FLOW AND THEIR STRUCTURE WITH DEPTH

Patterns of current flow inferred from geostrophy with respect to the 500 db surface in August 1973 showed the surface current flow patterns to be similar to those found at depths from the surface to 375 m. The area studied was characterized by narrow bands of interlacing poleward and equatorward flow. Generally, the flow in this area tended to follow bathymetric contours, and there was evidence that the bottom topography influenced the direction of flow within the 1,000 fathom curve. Additionally, independent current flow

measurements made using parachute drogues during August 1972 and August 1973 by Wickham [1975] confirm the general flow patterns inferred from geostrophy.

C. TEMPORAL VARIATION OF THE GEOSTROPHIC FLOW

The variation of the geostrophic flow with time inferred from geostrophy with respect to the 500 db surface showed that the general surface flow patterns over the time period, August 1973 through January 1974, are similar to those found at depths from the surface to 300 m. The geostrophic flow was more intense during the period November 1973 through January 1974 than during August 1973 through October 1973 in the upper 200 m. What appear to be narrow bands of poleward and equatorward flow, which could result from transient effects due to the redistribution of mass by internal waves, characterized the study area. Additionally, the equatorward flow in the eastern sector of the area appeared to be more intense in the upper 200 m during December 1973 and January 1974 than the poleward flow. Finally, the time history showed the poleward flow to shift to the west with time.

The variation of the geostrophic flow with time over the period January 1974 through August 1974 showed the flow to be more intense during January, June and August 1974 than during February, March and July 1974. Additionally, current speeds at depth during January through August 1974 were significantly less than speeds at depth during August 1973 through January 1974. And a reversal in flow direction in the upper 200 m was revealed between June and July 1974.

D. GEOSTROPHIC CURRENT AND SALT TRANSPORT

The vertical structure of geostrophic flow, depicted by monthly vertical cross sections of geostrophic salt transport contours, showed three distinct oceanographic seasons, and were consistent with Skogsberg's [1936] annual cycle of the California Current System. The flow and structure inferred from geostrophy in the area appeared highly complex with interlacing narrow bands (many times less than 10 km in width) of poleward and equatorward flow. Additionally, equatorward and poleward jets (speeds up to 77 cm/sec) were found to have axes corresponding to sharp water mass boundaries indicated by large angles between the isopycnal and isothermal surfaces.

A P P E N D I X A

```
C  TITLE           DIGISTD
C
C
C  PROGRAMMERS     R.E.GREER,R.E.BLUMBERG,AND J.G.HUGHES EXTENSIVELY MODIFIED AN
C                  ORIGINAL PROGRAM,MIZ2, BY R.G.PAQUETTE.
C
C  DOCUMENTATION   R.E.GREER
C
C  DATE            26 JUNE 1975
C
C  PURPOSE         PROGRAM READS,CONVERTS,AND PROCESSES DIGITIZED SALINITY,
C                  TEMPERATURE,AND DEPTH DATA FROM A CALMA DIGITIZER 7-TRACK
C                  TAPE.  DATA ARE COMPUTED AND STORED EVERY 0.01 INCHES OF DEPTH
C                  FOR OUTPUT TO PRINTER,PUNCHED CARD,OR 9-TRACK TAPE.  PROGRAM
C                  CONVERTS DEPTH,TEMPERATURE,SALINITY AND COMPUTES SOUND VELOCITY
C                  AND SIGMA-T FOR EACH INDIVIDUAL OCEANOGRAPHIC STATION AND
C                  PRINTS THE DATA IN A STATION DATA SUMMARY.
C
C  SEQUENCE        THE PROGRAM PERFORMS ALL FUNCTIONS IN THE FOLLOWING SEQUENCE
C                  OF OPERATIONS:
C                     (A) INITIALIZES ALL ARRAYS AND VARIABLES.
C                     (B) COMPUTES TABLE OF SALINTIY AND TEMPERATURE SCALE
C                     COMVERSION FACTORS.
C                     (C) SKIPS XXX NUMBER OF RECORDS IF NSKP VARIABLE SET OTHER
C                     THAN ZERO ON CONTROL DATA CARD.
C                     (D) READS PAIR OF DATA CARDS (LABEL AND DAT) FOR RECORD
C                     BEING PROCESSED.
C                     (E) TERMINATES PROGRAM IF ISTOP=1 OR AT THE END OF
C                     PROCESSING THE NN-TH RECORD.
C                     (F) SKIPS UNREADABLE OR BAD RECORDS IF NRCSKP VARIABLE SET
C                     TO INDIVIDUAL RECORD NUMBER.
C                     (G) READS USEABLE DATA RECORD INTO A-ARRAY.
C                     (H) MOVES BYTES OF A-ARRAY INTO 4-BYTE WORDS OF B-ARRAY TO
C                     ALLOW PROCESSING BY STANDARD FORTRAN.
C                     (I) PROCESSES RAW B-ARRAY.
C                        (1) IF HEADER RECORD, PROGRAM DECODES HEADER LABEL AND
C                        COMPARES TO LABEL SUPPLIED BY DATA CARD.
C                        (2) IF TRACER RECORD, PROGRAM ADDS AND STORES CUMULATIVE
C                        SUMS OF X AND Y DISTANCE TRAVEL.
C                     (J) INDEXES THE VALUES OF CUMULATIVE DISTANCE BY INCREASING
C                     DEPTH UNITS; INTERPOLATES TO FILL GAPS IN THE FINAL ARRAY
C                     WHICH MAY OCCUR AT THE POINTS OF SCALE CHANGES IN THE
C                     SEGMENTED RECORD.
C                     (K) INSERTS MANUALLY ENTERED SURFACE AND NEAR SURFACE DATA
```

```
C                VALUES VIA DATA CARD.
C                (L) INCREMENTS RECORD COUNT AND REPEATS STEPS (D) THRU (K)
C                UNTIL ALL RECORDS PROCESSED FOR PARTICULAR STATION.
C                (M) ADJUSTS ALL FINAL DATA ARRAYS TO THE LENGTH OF THE
C                SHORTEST.
C                (O) COMPUTES SOUND VELOCITY.
C                (P) COMPUTES SIGMA-T.
C                (Q) COMPUTES CONSECUTIVE RECORD SERIALIZATION FOR TAPE
C                OUTPUT NUMBERING SCHEME.
C                (R) CONVERTS LETTER DESIGNATOR MONTH/YEAR CODE,AMONC, TO
C                REAL *8 MONTH/YEAR.
C                (S) PRINTS OCEANOGRAPHIC DATA STATION SUMMARY.
C                (T) WRITES ALL STATION DATA ON TAPE IF TAPE=.TRUE..
C                (U) PUNCHES ALL STATION DATA ON CARDS SUITABLE FOR THESISII
C                INPUT IF CARDS=.TRUE..
C                (V) PUNCHES DEPTH,TEMPERATURE,AND SALINITY ON CARDS
C                SUITABLE FOR INPUT TO HYDROGRAPHIC PROGRAM IF GCARDS=.TRUE..
C                (W) INITIALIZES ALL ARRAYS AND VARIABLES FOR PROCESSING
C                NEXT STATION DATA.
C                (X) REPEATS STEPS (D) THRU (W) UNTIL ALL RECORDS PROCESSED,
C                ISTOP=1, OR DESIRED RECORD READ.
C
C FEATURES       PROGRAM CONSISTS OF MANY MARKED PROPERTIES WHICH MAKE IT A
C                HIGHLY VERSATILE PROGRAM FOR PROCESSING OCEANOGRAPHIC DATA
C                FROM TAPE. SOME OF THESE PROPERTIES ARE LISTED UNDER THE
C                FOLLOWING SIX GENERAL CATEGORIES:
C                   (A) INPUT
C                      (1) 7-TRACK CALMA DIGITIZER TAPE IN BCD.
C                      (2) TWO DATA CARDS REQUIRED PER TRACE SEGMENT OR HEADER
C                      LABEL RECORD. EXAMPLE:  AN STD TEMPERATURE TRACE
C                      CONSISTING OF FOUR SEGMENTS OR RECORDS WILL REQUIRE FOUR
C                      PAIRS OF DATA CARDS.
C                   (B) SUBROUTINES
C                      (1) TPRD-  AN ASSEMBLER LANGUAGE SUBROUTINE FOR READING
C                      MAGNETIC TAPE WHICH CANNOT BE READ BY STANDARD METHODS.
C                      NOTE: TPRD ALLOWS USER TO SKIP BAD RECORDS WHILE TAPRD
C                      (W.R.CHURCH COMPUTER CENTER SUBROUTINE) DOES NOT.
C                      (2) CHMOVE-  MOVES BYTES OF A-ARRAY INTO FOUR BYTE WORDS
C                      OF B-ARRAY TO ALLOW PROCESSING BY STANDARD FORTRAN.
C                      (3) CONDNS-  CONDENSES,INDEXES,AND CONVERTS THE
C                      CUMULATIVE DISTANCE X AND Y ARRAYS,BY INCREASING DEPTH
C                      UNITS,TO TEMPERATURE AND DEPTH OR SALINITY AND DEPTH.
C                      (4) OUT1-  PRINTS OCEANOGRAPHIC STATION DATA SUMMARY.
C                      (5) SVEL-  COMPUTES SOUND VELOCITY FROM DEPTH,TEMPERATURE
C                      AND SALINITY ACCORDING TO WILSON'S EQUATION.
C                      (6) SIGMT-  COMPUTES SIGMA-T FROM TEMPERATURE AND
C                      SALINITY ACCORDING TO H.O.614 P.91.
C                   (C) AUTOMATIC DATA PROCESSING/HANDLING
```

```
C                  (1) APPLICABLE TO MULTIPLE DEPTH,TEMPERATURE AND SALINITY
C                  SCALES.
C                  (2) HANDLES OPERATOR MISTAKES MADE IN TRACING STD CURVES
C                  ON CALMA DIGITIZER.
C                  (3) SKIPS AN INITIAL NUMBER OF RECORDS SPECIFIED BY NSKP
C                  AND INDIVIDUAL RECORDS(EVEN IF UNREADABLE) SPECIFIED BY
C                  THE ARRAY NRCSKP.
C                  (4) DECODES 7-TRACK TAPE HEADER LABELS AND TRACE RECORDS.
C                  (5) COMPUTES DATA FOR EVERY 0.01 INCHES DEPTH BUT
C                  SELECTABLE FOR GREATER DEPTH INTERVAL.
C                  (6) ENTERS HAND-ENTERED DATA FOR SURFACE AND NEAR-SURFACE
C                  VALUES.
C                  (7) EDITS OUT ANY UNFILLED ARRAY POSITIONS.
C                  (8) COMPUTES CONSECUTIVE RECORD SERIALIZATION FOR TAPE
C                  OUTPUT NUMBERING SCHEME.
C                  (9) COMPUTES SOUND VELOCITY AND SIGMA-T.
C               (D) DIAGNOSTICS
C                  (1) WRITES FIRST TWENTY-FIVE VALUES OF B-ARRAY FOR
C                  INSPECTION PURPOSES.
C                  (2) WRITES EVERY TWENTIETH VALUE OF STD ARRAYS FOR
C                  DATA INSPECTION PURPOSES.
C                  (3) WRITES PROGRAM STATEMENT NUMBER IN ADDITION TO
C                  MESSAGE WHEN SIGNIFICANT OPERATIONS OCCUR.
C               (E) TROUBLE-SHOOTING
C                  (1) HANDLES MULTIPLE KEYBOARD AND TRACER SYMBOL ENTRIES.
C                  (2) PROVIDES FOR A MISSED HEADER LABEL OR INCOMPLETE
C                  HEADER LABEL.
C                  (3) HANDLES MISSING INTER-RECORD GAPS.
C                  (4) HANDLES DELETE RECORD BY INCREMENTING RECORD COUNT
C                  AND READING SAME PAIR OF DATA CARDS AGAIN.
C                  (5) COMPARES CARD HEADER LABEL AGAINST TAPE HEADER LABEL
C                  AND ACCEPTS CARD VALUES IF CARD AND TAPE DISAGREE.
C               (F) OUTPUT
C                  (1) PRINTER-  TWO PRINTING VARIABLES,PRT1 AND PRT2.
C                     (A) OCEANOGRAPHIC DATA STATION SUMMARIES.
C                     (B) PRT2, PROVISION ONLY.
C                  (2) CARD-  TWO CARD PUNCHING ROUTINES,CARDS AND GCARDS.
C                     (A) PUNCHED DATA CARDS SUITABLE FOR USE WITH THESISII.
C                     (B) PUNCHED DATA CARDS FOR INPUT TO HYDROGRAPHIC
C                     PROGRAM.
C                  (3) TAPE-  9-TRACK TAPE
C                  (4) PLOTTING-  PROVISIONS FOR PLOTTING ROUTINES ACTUATED
C                  BY PLT1 AND PLT2 ARE NOT PRESENTLY PROGRAMMED.
C
C ARGUMENTS       PROGRAM CONSISTS OF MANY TERMS,ARRAYS AND VARIABLES.  THE
C                 FOLLOWING IS A BRIEF DESCRIPTION OF THE IMPORTANT ARGUMENTS
C                 LISTED ALPHABETICALLY UNDER TWO GENERAL CATEGORIES.
C                    (A) ARRAYS
```

```
C                (1) D,T,S,D2,T2,S2   = DEPH,TEMPERATURE AND SALINITY
C                (2) DH,TH,SH         = HAND-ENTERED SURFACE AND NEAR
C                                       SURFACE DATA VALUES.
C                (3) X,Y              = CUMULATIVE SUMS OF DISTANCE AND
C                                       DEPTH TRAVEL.
C                (4) NRCSKP           = NUMBER OF INDIVIDUAL RECORD SKIPPED
C                (5) DCON             = DEPTH CONVERSION FACTOR.
C                (6) CORRS,CORRT      = ADDITIVE CORRECTIONS TO SALINITY
C                                       AND TEMPERATURE ASSOCIATED WITH STD
C                                       SCALE CHANGES.
C                (7) IREC             = CONSECUTIVE SERIAL RECORD NUMBER.
C                (8) AMONCA           = MONTH/YEAR CODE LETTER.
C                (9) EVENT            = MONTH AND YEAR.
C           (B) TERMS
C                (1) CARDS            = VARIABLE PERMITS PUNCHING CARDS.
C                (2) CONTRL           = NAMELIST VARIABLE USED FOR
C                                       INFREQUENTLY CHANGED VARIABLES.
C                (3) CORD             = DEPTH CORRECTION TERM.
C                (4) DAT              = NAMELIST VARIABLE USED FOR
C                                       FREQUENTLY CHANGED VARIABLES.
C                (5) DLTREC           = DELETE RECORD
C                (6) FLAG             = INDICATES START OF DATA TRACE.
C                (7) GCARDS           = VARIABLE PERMITS PUNCHING CARDS FOR
C                                       HYDROGRAPHIC PROGRAM INPUT.
C                (8) GCRD             = NUMBER OF HYDROGRAPHIC CARDS TO BE
C                                       PUNCHED.
C                (9) ICODE            = VARIABLE USED TO IDENTIFY EITHER
C                                       TEMPERATURE OR SALINITY TRACE RECORD.
C                (10) ICSQZ           = VARIABLE USED TO COMPRESS NUMBER
C                                       OF DATA VALUES OUTPUT TO CARDS
C                                       PUNCHING ROUTINE.
C                (11) IGSQZ           = VARIABLE USED TO COMPRESS NUMBER
C                                       OF DATA VALUES OUTPUT TO GCARDS
C                                       PUNCHING ROUTINE.
C                (12) ISQZ            = VARIABLE USED TO COMPRESS NUMBER
C                                       OF DATA VALUES OUTPUT TO PRINTER.
C                (13) IDEPTH          = VARIABLE USED TO IDENTIFY HEADER
C                                       LABEL OR TRACE RECORD.
C                (14) ISCL            = THE SCALE NUMBER ON THE STD
C                                       SALINITY SCALE DIAL.
C                (15) ITSCL           = THE SCALE NUMBER ON THE STD
C                                       TEMPERATURE SCALE DIAL.
C                (16) IDSCL           = THE SCALE NUMBER ON THE STD DEPTH
C                                       SCALE DIAL.
C                (17) ISTA            = VARIABLE IDENTIFIES STATION NUMBER.
C                (18) IP              = WHEN SET EQUAL TO 1 ON &DAT, IP IS
C                                       A PRINT COMMAND TO CAUSE DATA TO BE
C                                       OUTPUT AND VARIABLES INITIALIZED FOR
```

```
C                                  THE NEXT STATION.
C          (19) IH                 = NUMBER OF HAND-ENTERED SURFACE OR
C                                  NEAR-SURFACE DATA VALUES.
C          (20) IHDR               = WHEN SET EQUAL TO 1 PERMITS
C                                  ENTERING MISSING OR FAULTY DIGITIZER
C                                  TAPE HEADER INFO VIA DATA CARD.
C          (21) ISTOP              = TERMINATES PROGRAM IF SET EQUAL TO
C                                  1 ON A FINAL &DAT CARD PRECEDED BY
C                                  A LABEL CARD.
C          (22) JREC               = VARIABLE USED TO COUNT RECORDS FOR
C                                  RECORD SERIALIZATION PURPOSES.
C          (23) JSKIP              = WHEN SET EQUAL TO 1 ON THE LABEL
C                                  CARD, CAUSES THE PROGRAM TO ACCEPT
C                                  DATA ON AN &CONTRL CARD.
C          (24) KEY                = THE KEYBOARD SYMBOL ON THE
C                                  DIGITIZER TAPE.
C          (25) KCRD               = NUMBER OF DATA POINTS TO BE PUNCHED
C                                  BY CARDS PUNCHING ROUTINE.
C          (26) KDTA               = NUMBER OF RECORDS PROCESSED FOR
C                                  PARTICULAR STATION.
C          (27) LABEL              = HEADER TYPE DATA CARD WHICH
C                                  IDENTIFIES STATION NUMBER AND TYPE
C                                  TRACE, TEMPERATURE OR SALINITY.
C          (28) NCRDS              = NUMBER OF CARDS PUNCHED BY CARDS
C                                  PUNCHING ROUTINE.
C          (29) NE                 = THE INDEX AT THE LAST USEFUL ARRAY
C                                  POSITION OF THE X(DEPTH) ARRAY.
C          (30) NOIRG              = VARIABLE USED TO INDICATE MISSING
C                                  END OF RECORD GAP ON TAPE.
C          (31) NSKP               = NUMBER OF INITIAL RECORDS ON TAPE
C                                  SKIPPED.
C          (32) SCON               = SALINITY SCALE CONSTANT.
C          (33) SCOR               = CORRECTION FACTOR ADDED TO SALINITY
C                                  DATA VALUES.
C          (34) TCON               = TEMPERATURE SCALE CONSTANT.
C          (35) TCOR               = CORRECTION FACTOR ADDED TO
C                                  TEMPERATURE DATA VALUES.
C          (36) WMONTH             = MONTH AND YEAR
C
C DATA DECK       THE FOLLOWING IS A SAMPLE DATA DECK REQUIRED BY THIS
C                 PROGRAM. SAMPLE BELOW SHOWS DATA CARDS REQUIRED FOR TWO
C                 STATIONS, 3070 AND 3080. ALSO SHOWN IS 'STATION END' CARD
C                 WTIH ISTOP SET EQUAL TO ONE.
C
 &CONTRL NN=400,TAPE=F,CARDS=F,GCARDS=F,ISQZ=01,NSKP=90,NRCSKP=103,104,105,
 106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,
 124,125,126,175,176,177,178,179,180,181,182,183,184,185,186,ICSQZ=8,
```

```
IGSQZ=8,TCOR=-0.08,SCOR=0.04,&END
    UCM004    INCLUDES STATIONS  3070 THRU 302R MINUS 3080,3090 AND 3140.
STATION 3070 TEMPERATURE HEADER                                          0
&DAT ISTA=307,AMONC='0',IDEPTH=99,IDSCL=1,ICODE=0,ITSCL=4,ISCL=3,IP=0,
DH=0.0,TH=11.24,SH=33.40,IH=1,&END
STATION 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3070 TEMPERATURE HEADER                                          0
&DAT IDEPTH=99,ITSCL=3&END
STATION 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3070 TEMPERATURE HEADER                                          0
&DAT IDEPTH=99,IDSCL=2&END
STATION 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3070 TEMPERATURE HEADER                                          0
&DAT IDEPTH=99,ITSCL=2&END
STATION 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3070 SALINITY HEADER                                             0
&DAT IDSCL=1,IDEPTH=99,ICODE=1,ITSCL=4,&END
STATION 3070 SALINITY TRACE                                              0
&DAT  IDEPTH=00&END
STATION 3070 SALINITY HEADER                                             0
&DAT IDSCL=2,IDEPTH=99,IP=1,&END
STATION 3070 SALINITY TRACE                                              0
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                          0
&DAT ISTA=308,AMONC='0',IDEPTH=99,IDSCL=1,ICODE=0,ITSCL=4,ISCL=3,IP=0,&END
STATION 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                          0
&DAT IDEPTH=99,ITSCL=3,&END
STATION 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                          0
&DAT IDEPTH=99,IDSCL=2&END
STATION 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                          0
&DAT IDEPTH=99,ITSCL=2&END
STATION 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 SALINITY HEADER                                             0
&DAT IDSCL=1,IDEPTH=99,ICODE=1,ITSCL=4,&END
STATION 3080 SALINITY TRACE                                              0
&DAT  IDEPTH=00&END
STATION 3080 SALINITY HEADER                                             0
```

```
 &DAT IDSCL=2,IDEPTH=99,IP=1,&END
 STATION 3080 SALINITY TRACE                                                  0
 &DAT  IDEPTH=00&END
 STATION END                                                                  1
C (END OF FILE)
C
C
C DECK SET-UP     THE FOLLOWING IS AN EXAMPLE OF JOB CONTROL LANGUAGE
C                 AND DECK SET-UP REQUIRED TO USE DIGISTD. THIS
C                 PARTICULAR DECK SET-UP WAS USED TO WRITE FILE 6 ON
C                 9-TRACK TAPE, NPS-527. THE 9-TRACK TAPE WAS WRITTEN AT
C                 800 BPI WITH A LRECL OF 40 AND BLKSIZE OF 32,520.
C                 HINDSIGHT INDICATES THAT IT IS DESIRABLE TO WRITE
C                 THE TAPE AT A BLKSIZE OF 8000 VICE 32,520 SINCE IT IS
C                 EXTREMELY ADVANTAGEOUS TO KEEP FOLLOW ON TAPE
C                 PROCESSING PROGRAMS SMALL (IE LESS THAN 100K).
C
C
//GUCMSTD6 JOB (2006,0823,OS42),' RE GREER SMC 1413',TIME=10,
//     TYPRUN=HOLD,
//     MSGCLASS=O
// EXEC FORTCLG,REGION.FORT=150K,REGION.GO=350K,DEST=O
//FORT.SYSIN DD *
C       ( MAIN SOURCE DECK AND SUBROUTINES)
//GO.FT06F001 DD SPACE=(CYL,(40,03)),SYSOUT=O
//GO.FT07F001 DD DUMMY
//GO.FT08F001 DD UNIT=3400-4,VOL=SER=NPS527,LABEL=(06,SL,,OUT),
//   DISP=(NEW,KEEP),DCB=(DEN=2,RECFM=FB,LRECL=40,BLKSIZE=32520),
//   DSN=S2006.UCM7374
//GO.METTAP DD UNIT=2400-1,VOL=SER=UCM004,DISP=OLD,LABEL=(,NL),
//        DCB=(DEN=1,TRTCH=ET)
//GO.SYSIN DD *
C       (DATA DECK)
C (END OF FILE)
```

```
C
C MAIN PROGRAM
C
C
C       ********************  D I G I S T D  ************************          5
C                                                                              10
C                                                                              15
      DIMENSION X(4001), Y(4001), LABEL(19), SH(50), TH(50), DH(50),           20
     1INTA(10), INSA(10), NRCSKP(99), DCON(3), CORRS(7), CORRT(7),             25
     2IREC(1801), AMONCA(13), EVENT(13)                                        30
      INTEGER B(8001),ZER,DOL,STAR,ONE,FLAG,DLTREC,ZERO,DLR,BLANK,GCRD,        35
     1A(2001),TWO,THREE,FOUR,FIVE,SIX,SEVEN,EIGHT,TEN,ELEVEN,AMONT,FG          40
      LOGICAL PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,SKIP,GCARDS                 45
      COMMON /C1/ T(1801),S(1801),D(1801),SV(1801),SIG(1801),                  50
     1S1(1801),T1(1801),D2(1801),S2(1801),T2(1801)                             51
      REAL *8EVENT,WMONTH                                                      52
      DATA AMONCA/'H','I','C','K','L','O','P','Q','R','U','V','W','Z'/        53
      DATA EVENT/'AUG 1973','SEP 1973','OCT 1973','NOV 1973','DEC 1973',       54
     1'JAN 1974','FEB 1974','MAR 1974','APR 1974','MAY 1974','JUN 1974',       55
     2'JUL 1974','AUG 1974'/                                                   56
C     ************************************************************           60
C                                                                              65
      NAMELIST /CONTRL/ NN,PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,ISTOP,IP       70
     1,IH,NRCSKP,NSKP,JSKIP,JREC,ISQZ,ICSQZ,IGSQZ,GCARDS,TCOR,SCOR            75
     2/DAT/SH,TH,DH,IH,ICODE,ISCL,ITSCL,IDSCL,IP,IDEPTH,ISQZ,IGSQZ,ICSQZ      80
     3,SCOR,TCOR,IHDR,NOIRG,ISTA,TCON,SCON,DCON,CCRD,SKIP,CORRS,CORRT,         85
     4AMONC,TAPE,CARDS,GCARDS                                                  90
C
C       ************************************************************           95
C       ********************** DEFINE SYMBOLS **********************          100
C
C       DEFINE SYMBOLS,NOTING THAT THE LEFT THREE HEX BYTES IN EACH            105
C       ELEMENT OF B END UP FILLED WITH BLANKS                                 110
      DATA DOL/'$$$$'/,STAR/Z4040405C/,KEY/Z4040405F/,ONE/Z404040F1/,          115
     1FLAG/Z40404050/,DLTREC/Z40404060/,MINUS/Z40404061/,                      120
     2 DLR/Z4040405B/,BLANK/'    '/,ZER/Z404040F0/,TWO/Z404040F2/,             125
     3THREE/Z404040F3/,FOUR/Z404040F4/,FIVE/Z404040F5/,                        130
     4MTWO/Z404040E2/,MTHREE/Z404040E3/,MFOUR/Z404040E4/,MFIVE/Z404040E5       135
     5/,SIX/Z404040F6/,SEVEN/Z404040F7/,EIGHT/Z404040F8/,NINE/Z404040F9        140
     6/,TEN/Z404040F0/,ELEVEN/Z4040407B/                                       145
C
C       ************************************************************          150
C       ********************** DEFINE CONSTANTS ********************          155
C
C       THE FOLLOWING CONVERSION FACTORS ARE IN HUNDREDTHS OF INCHES PER       160
C       UNIT OF S OR T.  THEY MAY BE OVERRIDDEN BY THE DATA CARDS.             165
      DCON(1) = 3.153                                                          170
      DCON(2) = 1.261                                                          175
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      DCON(3) = 0.631                                                    180
      TCON = 189.680                                                     185
      SCON = 474.200                                                     190
C
CCC    ************************************************************     195
CCC    ************** INITIALIZE ALL TERMS AND VARIABLES **************     200
C                                                                        205
      DATA CARDS/.FALSE./,CORD/0.0/,ENDFL/.FALSE./,FG/0/,GCARDS/.FALSE./ 210
     1,ICODE/0/,ICSQZ/1/,IGSQZ/1/,IH/0/,IHDR/0/,IP/0/,IPS/8000/,ISCL/0/, 215
     2IDEPTH/1/,IDSCL/0/,ISTA/999/,ITSCL/0/,                             220
     3ISQZ/1/,ISTOP/0/,JJJ/0/,JJJJ/0/,JREC/0/,JSAV/0/,KBARF/0/,KSCARF/0/ 225
     4,KDTAF/1/,KDTA/1/,KDT1/1/,KDTH1/1/,KDTH2/1/,KS/1/,KS1/1/,          230
     5KS2/1/,KT/1/,KT1/1/,KT2/1/,NE/0/,NOIRG/0/,NSKP/0/,PLT1/.FALSE./,   235
     6PLT2/.FALSE./,PRT1/.TRUE./,PRT2/.FALSE./,SCOR/0.0/,SKIP/.FALSE./,  240
     7TAPE/.FALSE./,TCOR/0.0/                                            245
C
CCC    ************************************************************     250
CCC    ********************* INITIALIZE ALL ARRAYS *********************     255
CCC                                                                      260
CCC    GIVE THE ARRAYS INITIAL VALUES                                    265
CCC                                                                      270
C                                                                        275
      DO 20 J=1,50                                                       280
      SH(J) = 0.0                                                        285
      TH(J) =-5.0                                                        290
      DH(J) = 0.0                                                        295
   20 CONTINUE                                                           300
C                                                                        305
CCC                                                                      310
CCC                                                                      315
C                                                                        320
      DO 30 J=1,1801                                                     325
      D(J) = 0.0                                                         330
      T(J) =-5.0                                                         335
      S(J) = 0.0                                                         340
      D2(J) = 0.0                                                        345
      T2(J) =-5.0                                                        350
      S2(J) = 0.0                                                        355
      T1(J) =-5.0                                                        360
      S1(J) = 0.0                                                        365
      IREC(J) = 0                                                        370
   30 CONTINUE                                                           375
C                                                                        380
CCC                                                                      385
CCC                                                                      390
C                                                                        395
      DO 40 J=1,99                                                       400
      NRCSKP(J) = 0                                                      405
```

```
   40 CONTINUE                                                          410
C                                                                       415
C                                                                       420
C                                                                       425
C                                                                       430
      DO 50 J=1,7,1                                                     435
      CORRS(J) = 0.0                                                    440
      CORRT(J) = 0.0                                                    445
   50 CONTINUE                                                          450
C                                                                       455
C                                                                       460
C      PROVIDE INITIAL INDICES FOR 10 SALINITY SEGMENTS (INSA) AND 10   465
C      TEMPERATURE SEGMENTS (INTA).                                     470
      INSA(1) = 1                                                       475
      INSA(2) = 1                                                       480
      INTA(1) = 1                                                       485
      INTA(2) = 1                                                       490
C                                                                       500
      DO 60 J=3,10                                                      505
      INSA(J) = 980                                                     510
      INTA(J) = 980                                                     515
   60 CONTINUE                                                          520
C                                                                       525
C      COMPUTE A TABLE OF CONVERSION FACTORS FOR SALINITY AND           535
C      TEMPERATURE. CORRS AND CORRT REPRESENT THE S OR T VALUE AT THE   540
C      LEFT HAND SIDE OF THE STD TRACE. THE VALUE (J) TO BE USED WILL   545
C      COME FROM ISCL AND ITSCL. HYTECH STD MODEL 9006 STANDARD         550
C      TEMPERATURE AND SALINITY SCALES 1 THRU 7 ARE PROVIDED FOR IN     555
C      THIS PROGRAM IN ADDITION TO DEPTH SCALES 1,2, AND 3. FOR         560
C      CONVENIENCE THE SCALES FOR TEMPERATURE, SALINITY, AND DEPTH ARE  565
C      DEFINED HERE.                                                    570
C      TEMPERATURE SCALES:                                              575
C         ITSCL 1= -2 TO 3  (DEG CELSIUS)                               580
C         ITSCL 2=  2 TO 7  (DEG CELSIUS)                               585
C         ITSCL 3=  6 TO 11 (DEG CELSIUS)                               590
C         ITSCL 4= 10 TO 15 (DEG CELSIUS)                               595
C         ITSCL 5= 14 TO 19 (DEG CELSIUS)                               600
C         ITSCL 6= 18 TO 23 (DEG CELSIUS)                               605
C         ITSCL 7= 22 TO 27 (DEG CELSIUS)                               610
C      SALINITY SCALES:                                                 615
C         ISCL  1= 30.0 TO 32.0  (PPT)                                  620
C         ISCL  2= 31.5 TO 33.5  (PPT)                                  625
C         ISCL  3= 33.0 TO 35.0  (PPT)                                  630
C         ISCL  4= 34.5 TO 36.5  (PPT)                                  635
C         ISCL  5= 36.0 TO 38.0  (PPT)                                  640
C         ISCL  6= 37.5 TO 39.5  (PPT)                                  645
C         ISCL  7= 30.0 TO 40.0  (PPT)                                  650
C      DEPTH SCALES:                                                    655
```

```
C         DCON(1)=  0.0 TO 300.0  (METERS)                                660
C         DCON(2)=  0.0 TO 750.0  (METERS)                                665
C         DCON(3)=  0.0 TO 1500.0 (METERS)                                670
C                                                                         675
      CORRT(7) = 22.0                                                     680
      CORRS(7) = 30.0                                                     685
C                                                                         690
CC                                                                        695
      DO 70 J=1,6,1                                                       700
      FJ = J                                                              705
      CORRT(J) = -2.0+(FJ-1.0)*4.0                                        710
      CORRS(J) = 30.0+(FJ-1.0)*1.5                                        715
   70 CONTINUE                                                            720
C                                                                         725
CC                                                                        730
CC                                                                        735
CC     ************************************************************       740
CC     ***** BEGIN PROCESSING; READ INITIAL DATA FROM TWO CARDS ********  745
CC     PROGRAM PROVIDES FOR READING NSKP RECORDS WITHOUT PROCESSING.      750
CC     NSKP, AS WELL THE 99 VALUES OF NRCSKP MUST BE ON THE FIRST         755
CC     CONTRL CARD. A SINGLE CONTRL CARD IS READ HERE TO SET NSKP AND     760
CC     NRCSKP. THERE ALSO MAY BE AN INFORMATIVE LABEL EXPLAINING HOW      765
C      MANY AND WHICH RECORDS SKIPPED.                                    770
      READ (5,CONTRL)                                                     775
      READ (5,170) LABEL                                                  780
      WRITE (6,180) LABEL                                                 785
C                                                                         790
CC     IF TAPE=.TRUE., TAPE MUST BE REWOUND AND APPROPRIATE JCL MUST      795
CC     BE PROVIDED TO DEFINE IT. SEE JCL FOR EXAMPLE IN PRECEDING         800
C      PROGRAM DOCUMENTATION SECTION.                                     805
      IF (TAPE) REWIND 8                                                  810
      IF (NSKP.EQ.0) GO TO 140                                            815
C                                                                         820
CC     ************************************************************       825
CC     ************************ START SKIP LOOP ***********************  830
CC                                                                        835
C                                                                         840
      DO 80 IS=1,NSKP                                                     845
      IIS = IS                                                            850
C                                                                         855
CC     THE VARIABLE,IPS, IS SET NEGATIVE DURING THE RECORD SKIP PROCESS.  860
CC     THIS AVOIDS TPRD STOPPING ON UNREADABLE OR BAD RECORDS. NO DATA    865
CC     CARDS ARE REQUIRED FOR INITIALLY SKIPPED RECORDS.                  870
CC     IMPORTANT NOTE:  INITIALLY SKIPPED RECORDS (NSKP) DIFFER FROM      875
CC     INDIVIDUALLY SKIPPED RECORDS (NRCSKP) IN THAT NRCSKP REQUIRES      880
CC     DATA CARDS AND PERMITS 99 INDIVIDUAL RECORDS TO BE SKIPPED WHILE   885
CC     NSKP DOES NOT REQUIRE DATA CARDS AND PERMITS MULTIPLE RECORDS TO   890
C      BE SKIPPED. (IE. NSKP=40, THE FIRST 40 RECORDS ON THE TAPE BEING   895
```

```
C       READ WILL BE SKIPPED; WHEREAS NRCSKP=22,23,24,50 PERMITS RECORD          900
C       NUMBERS 22,23,24,50 TO BE SKIPPED INDIVIDUALLY.)                        905
C                                                                               910
      IPS = -8000                                                               915
   80 CALL TPRD (A,IPS,&100,&120)                                               920
C                                                                               925
CCC                                                                             930
CCC                                                                             935
C       ***************************************************************         940
C       ********** RESET IPS FOR NORMAL TAPE PROCESSING ***********            945
      IPS = 8000                                                                950
      WRITE (6,90) IIS                                                          955
   90 FORMAT (/5X,I5,' RECORDS SKIPPED'/)                                       960
      GO TO 140                                                                 965
C                                                                               970
C       IF END OR  ERROR MESSAGES OCCUR DURING SKIP ROUTINE, PROGRAM            975
C       STOPS.                                                                  980
  100 WRITE (6,110) IIS                                                         985
  110 FORMAT (/5X,'FOUND END OF FILE ON RECORD',I4,'DURING SKIP PROCESS'        990
     1 /)                                                                       995
      GO TO 1580                                                               1000
  120 WRITE (6,130) IIS,A(1),A(2),A(3),A(4)                                    1005
  130 FORMAT (/5X,'READ ERROR ON RECORD',I5,'ERROR STATISTICS ARE: ',4Z8        1010
     1)                                                                        1015
      GO TO 1580                                                               1020
C       ***************************************************************     1025
C       ********************** END SKIP LOOP **************************     1030
CCC                                                                            1035
C       REDEFINE LOOP INDEX TO START AT ONE.                                   1040
  140 NNN = NN-NSKP                                                            1045
C                                                                              1050
CCC     ***************************************************************     1055
C       ************** START MAIN LOOP FOR EACH RECORD ****************     1060
      IT = 1                                                                   1065
  150 IF (IT.GT.NNN) GO TO 1580                                                1070
      IPS = 8000                                                               1075
      NREC = IT+NSKP                                                           1080
      WRITE (6,160) NREC                                                       1085
  160 FORMAT (/5X,'LABEL  150; START MAIN LOOP.  RECORD NO. ',I3/)             1090
C                                                                              1095
C       PROGRAM PERMITS TREATMENT OF A KNOWN NUMBER OF RECORDS,NN, OR          1100
C       STOPPING WHEN ISTOP=1 ON STATION LABEL CARD. THE LABEL CARD HAS        1105
C       TWO DIGITS FOR CONTROL. THE 77-TH COLUMN IS JSKIP; IF JSKIP=0,         1110
C       ONLY TWO CARDS ARE READ. THE 78-TH COLUMN IS ISTOP; IF ISTOP=1,        1115
C       THE PROGRAM STOPS. NORMAL TERMINATION OF THE PROGRAM MAY BE            1120
C       ACCOMPLISHED IN TWO DISTINCT WAYS. EITHER SET NN TO DESIRED            1125
C       RECORD TO STOP OR PLACE A 'STATION END' LABEL CARD AT END OF DATA      1130
C       DECK WITH A ONE IN COLUMN 78. THE 79-TH COLUMN IS AMONC; AMONC IS      1135
```

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C       AN ALPHABETIC LETTER CODE FOR MONTH AND YEAR. THIS CODE IS          1140
C       CONVERTED TO LITERAL MONTH AND YEAR LATER ON IN PROGRAM.            1145
C                                                                           1150
      READ (5,170) LABEL,JSKIP,ISTOP,AMONC                                  1155
  170 FORMAT (19A4,2I1,A1)                                                  1160
      IF (ISTOP.GT.0) GO TO 1580                                            1165
      READ (5,DAT)                                                          1170
      WRITE (6,180) LABEL                                                   1175
      WRITE (6,DAT)                                                         1180
C       NORMALLY TWO CARDS, LABEL AND DAT, ARE READ PER RECORD.             1185
C       LESS FREQUENTLY CHANGED VARIABLES ARE ON CONTRL DATA CARD.          1190
      JJJJ = 0                                                              1195
      NOIRG = 0                                                             1200
      IF (JSKIP.EQ.0) GO TO 190                                             1205
      READ (5,CONTRL)                                                       1210
      WRITE (6,CONTRL)                                                      1215
  180 FORMAT (/5X,19A4/)                                                    1220
C                                                                           1225
C                                                                           1230
C       PROVISION IS MADE HERE FOR A MISSED HEADER LABEL ON TAPE (AN        1235
C       OPERATOR ERROR). IF IHDR=1,AND ALL INFORMATION REQUIRED IS PLACED   1240
C       ON PARTICULAR &DAT CARD, THE PROGRAM BRANCHES OFF TO  610 AND       1245
C       WRITES STATION INFORMATION AND MESSAGE THAT HEADER IS MISSING,      1250
C       AND FINALLY RETURNS TO 150 TO START NORMAL PROCESSING OF TRACE      1255
C       RECORD DATA. NOTE, RECORD COUNT IS NOT INCREMENTED IN THIS LOOP.    1260
C                                                                           1265
  190 IF (IHDR.EQ.1) GO TO 610                                              1270
  200 CONTINUE                                                              1275
C                                                                           1280
C       NOTE: IN EARLIER VERSIONS OF THIS PROGRAM, THERE WAS AN             1285
C       INTERPOLATION ROUTINE HERE FOR HAND-ENTERED DATA BUT IT WAS         1290
C       DELETED SINCE VERY SELDOM ONE HAD CAUSE TO USE IT. HOWEVER, THE     1295
C       CAPABILITY FOR HAND-ENTERED DATA HAS BEEN RETAINED BUT IN A         1300
C       DIFFERENT FORM. SEE COMMENTS FOLLOWING STATEMENT NO. 1130.          1305
C                                                                           1310
C--------------------                                                       1315
  210 FORMAT (5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.    1320
     12/5X,11F7.2/5X,11F7.2/5X,3F7.2,60X,I6)                                1325
  220 FORMAT (5X,10I5,'  INSA')                                             1330
  230 FORMAT (5X,10I5,'  INTA')                                             1335
  240 FORMAT (5X,' KS , KS1, KS2, KT , KT1, KT2, JJJ, NE ,KDTH1,KDTH2,KD    1340
     1TA,KDT1,JJJJ'/4X,8I5,2I6,3I5)                                         1345
C--------------------                                                       1350
C                                                                           1355
C--------------------                                                       1360
      IPLACE=245                                                            1365
      WRITE (6,210) (D(J),J=1,1801,20)                                      1370
      WRITE (6,210) (T(J),J=1,1801,20),IPLACE                               1375
```

```
      WRITE (6,210) (S(J),J=1,1801,20),IPLACE                                  1370
      WRITE (6,220) (INSA(J),J=1,10)                                           1375
      WRITE (6,230) (INTA(J),J=1,10)                                           1380
      WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J      1385
     1JJJ                                                                      1390
C-----------------                                                            1395
CC                                                                            1400
CCC                                                                           1405
CCC      FILL THE A ARRAY WITH DOLLARS                                        1410
CCC                                                                           1415
C                                                                             1420
      DO 250 I=1,2001                                                         1425
C      THE 2001 ASSURES THAT THE LAST WORD OF A WILL CONTAIN DOLLARS          1430
C      SINCE 2000 WORDS OR 8000 BYTES OF DATA ARE READ IN.                    1435
      A(I) = DOL                                                              1440
  250 CONTINUE                                                                1445
C                                                                             1450
CCC                                                                           1455
CCC      FILL B WITH BLANKS                                                   1460
CCC                                                                           1465
C                                                                             1470
      DO 260 I=1,8000                                                         1475
      B(I) = BLANK                                                            1480
  260 CONTINUE                                                                1485
C                                                                             1490
CC       PROGRAM EXAMINES LIST OF INDIVIDUAL BAD RECORDS,NRCSKP,AND           1495
CC       SKIPS THEM. IF NRCSKP(1)=0, THE SKIP ROUTINE IS BY-PASSED.           1500
CC       CAUTION:  DO NOT REMOVE PAIRS OF DATA CARDS FOR INDIVIDUALLY         1505
CC       SKIPPED CARDS.                                                       1510
CC                                                                            1515
CC       IN USING THE CALMA DIGITIZER, SPURIOUS BLANK RECORDS OCCURRED        1520
CC       THROUGHOUT THE TAPE ON NUMEROUS OCCASSIONS. MANY OF THESE            1525
CC       OCCURRENCES WERE LATER TRACED TO EQUIPMENT MALFUNCTION.              1530
CC       HOWEVER, IF A BLANK RECORD OCCURS DURING A HEADER LABEL RECORD       1535
CC       NOTHING IS LOST SINCE HEADER INFO MAY BE INSERTED BY CARD AND        1540
CC       SETTING IHDR=1. ON THE OTHER HAND, IF A BLANK RECORD OCCURS          1545
CC       DURING A TRACE RECORD THE COMPLETE STATION IS LOST. FROM             1550
CC       EXPERIENCE, A BLANK RECORD WILL GENERALLY HAVE TWO CHARACTERS.       1555
CC       AFTER THE FIRST PROGRAM RUN AND A DETERMINATION OF BLANK OR          1560
CC       BAD RECORDS HAS BEEN MADE, THESE MAY BE SKIPPED INDIVIDUALLY VIA     1565
C        NRCSKP ROUTINE.                                                      1570
      IF (NRCSKP(1).EQ.0) GO TO 320                                           1575
C                                                                             1580
CCCCC    ********************************************************           1585
CCCCC    ********** START INDIVIDUAL RECORD SKIP LOOP **********              1590
CC                                                                            1595
```

```
      DO 270 LB=1,99                                                    1600
      NRC = NRCSKP(LB)-NSKP                                             1605
      IF (NRC.EQ.IT) GO TO 280                                          1610
  270 CONTINUE                                                          1615
C                                                                       1620
      GO TO 300                                                         1625
  280 IPS = -8000                                                       1630
  290 FORMAT (//5X,'LABEL 290. RECORD NO.',I5,' SKIPPED VIA NRCSKP SKIP 1635
     1 ROUTINE.'//)                                                     1640
      WRITE (6,290) IT                                                  1645
C     CHANGING IPS TO NEGATIVE CAUSES TPRD  TO SKIP A RECORD            1650
  300 IF (ICODE.EQ.0) GO TO 320                                         1655
      WRITE (6,310) IDEPTH,ICODE,ISCL                                   1660
  310 FORMAT (5X,'SALINITY VERSUS DEPTH'/                               1665
     1 5X,'STD RECORD STARTS AT ',I3,' METERS'/                         1670
     2 5X,'CODE =  ',I2/                                                1675
     3 5X,'SCALE = ',I2/)                                               1680
C                                                                       1685
C      ************************************************************     1690
C      ********************** READ TAPE ***************************     1695
  320 CALL TPRD (A,IPS,&350,&330)                                       1700
C                                                                       1705
C      IPS IS THE MAXIMUM NUMBER OF BYTES OF DATA WHICH WILL BE READ    1710
C      FROM ONE RECORD OF DIGITIZER TAPE BY TPRD. IPS/2 IS THE MAXIMUM  1715
C      TOTAL TRAVEL ALONG THE CURVE MEASURED IN 0.01 INCHES IN THE X    1720
C      AND Y DIRECTION SEPARATELY. 350 IS THE END OF FILE EXIT, AND 330 1725
C      IS THE READ-ERROR EXIT.                                          1726
      GO TO 360                                                         1730
  330 WRITE (6,340) A(1),A(2),A(3),A(4)                                 1735
  340 FORMAT (5X,'I10 ERROR STATISTICS TABLE IS ',4Z8)                   1740
C                                                                       1745
  350 CONTINUE                                                          1750
  360 CONTINUE                                                          1755
C                                                                       1760
C      ************************************************************     1765
C      ************** END INDIVIDUAL RECORD SKIP LOOP **************     1770
C                                                                       1775
C      PROCESS THE LAST RECORD                                          1780
C      MOVE THE BYTES OF A INTO THE 4-BYTE WORDS OF B USING CHMOVE.     1785
      JJ = 0                                                            1790
      JJJ = 0                                                           1795
C                                                                       1800
C                                                                       1805
      DO 370 II=1,2000                                                  1810
C                                                                       1815
C                                                                       1820
      DO 370 I=1,4                                                      1825
      JJ = JJ+1                                                         1830
```

```
      CALL CHMOVE (A(II),I,B(JJ),4)                                          1835
      IF (B(JJ).EQ.DLR) GO TO 380                                            1840
C      END OF DATA DETECTED                                                  1845
C      THERE MAY BE A STAR BEFORE THE DOLLAR                                 1850
  370 CONTINUE                                                               1855
C                                                                            1860
CC                                                                           1865
  380 CONTINUE                                                               1870
      B(8001) = DLR                                                          1875
C                                                                            1880
CCC    ************************************************************          1885
CCC    ***************** PREPARE TO PROCESS RAW ARRAY ******************      1890
C                                                                            1895
      WRITE (6,390) JJ,(B(J),J=1,25)                                         1900
  390 FORMAT (/5X,'LABEL 390.  ARRAY B IS FILLED; LOOK FOR MODE CHARACTE     1905
     1R.  THE NUMBER OF ARRAY ELEMENTS PROCESSED INCLUDING STARS AND '/      1910
     2 5X,'DOLLARS, JJ= ',I5,/5X,'FIRST  25 CHARACTERS ARE: ',               1915
     3 10(1X,Z8)/5X,10(1X,Z8)/5X,5(1X,Z8)/)                                 1920
C                                                                            1925
CCC    ************************************************************          1930
C                                                                            1935
      JJ = 1                                                                 1940
      GO TO 430                                                              1945
C                                                                            1950
CCCCC  ************************************************************          1955
CCCCC  ******************** START MISSING IRG ROUTINE **********************  1960
C                                                                            1965
C      THE FOLLOWING ROUTINE READS ANOTHER SET OF CARDS.  THIS IS THE        1970
C      ENTRY FOR THE SITUATIONS IN WHICH THE IRG IS MISSED.                  1975
  400 READ (5,170) LABEL,JSKIP,ISTOP,AMONC                                   1980
      IF (ISTOP.GT.0) GO TO 1580                                             1985
      IF (JSKIP.EQ.0) GO TO 410                                              1990
      READ (5,DAT)                                                           1995
      WRITE (6,180) LABEL                                                    2000
      WRITE (6,DAT)                                                          2005
      READ (5,CONTRL)                                                        2010
      WRITE (6,CONTRL)                                                       2015
C---------------------                                                       2020
  410 IPLACE=410                                                             2025
      WRITE (6,210) (D(J),J=1,1801,20)                                       2030
      WRITE (6,210) (T(J),J=1,1801,20),IPLACE                                2035
      WRITE (6,210) (S(J),J=1,1801,20),IPLACE                                2040
      WRITE (6,220) (INSA(J),J=1,10)                                         2045
      WRITE (6,230) (INTA(J),J=1,10)                                         2050
      WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J    2055
     1JJJ                                                                    2060
      WRITE (6,420) NOIRG,JJJJ                                               2065
  420 FORMAT (/5X,'LABEL 410.  PROCESSING SECOND HALF.  NOIRG=',I3,          2070
```

```
     1 'JJJJ=',I5/)                                                    2060
C---------------------
      NOIRG = 0                                                        2065
      JJ = JJJJ                                                        2070
C                                                                      2075
CC     ***************************************************************2080
CC     ********************END MISSING IRG ROUTINE ********************2085
C                                                                      2090
C      INITIALIZE ADDERS,ETC.                                          2095
  430 SUMD = 0.                                                        2100
      SUMD = 0.                                                        2105
      SUMT = 0.                                                        2110
      N = 0                                                            2115
      KL = 0                                                           2120
      KK = 0                                                           2125
C                                                                      2130
CC     ***************************************************************2135
CC     ************************ MODE SYMBOL CHECK ***********************2140
C                                                                      2145
  440 IF (B(JJ).EQ.KEY) GO TO 490                                      2150
C      THE FIRST ELEVEN VALUES OF THE B-ARRAY ARE CHECKED FOR A        2155
CC     KEYBOARD SYMBOL SINCE IT IS POSSIBLE TO HAVE GARBAGE VALUES AHEAD2160
CC     OF THE KEYBOARD SYMBOL. IF ALL ELEVEN VALUES ARE NOT KEYS       2165
CC     THEN JJ IS RESET TO 1 AND THE RECORD IS PROCESSED AS A TRACE.   2170
CC     HOWEVER, IF ONE OF THE ELEVEN VALUES ARE A KEY, PROGRAM BRANCHES2175
CC     TO 490, AND PROCESSES AS A HEADER. AT FIRST GLANCE, THIS        2180
CC     PROCEDURE APPEARS TO ASSUME THAT IT IS IMPOSSIBLE TO HAVE A     2185
CC     KEY SYMBOL APPEAR IN THE FIRST ELEVEN CHARACTERS OF A TRACE     2190
CC     RECORD. THIS IS NOT A BAD ASSUMPTION SINCE THE OPERATOR HAS TO  2195
CC     GO OUT OF HIS WAY TO INITIATE KEYBOARD MODE DURING TRACE MODE.  2200
CC     HOWEVER, LEAVING NOTHING TO CHANCE THE PROGRAM WILL KEEP        2205
CC     CHECKING FOR KEY OR TRACER UNTIL OPERATOR MAKES UP HIS MIND     2210
CC     WHICH MODE IS CORRECT. IF NO TRACER SYMBOLS APPEAR AFTER PROGRAM2215
CC     FINDS A KEY, THEN RECORD WILL BE PROCESSED AS A HEADER. ON THE  2220
CC     OTHER HAND, IF NO KEY SYMBOLS APPEAR AFTER PROGRAM FINDS A TRACER2225
C      THEN THE RECORD WILL BE PROCESSED AS A TRACE.                   2230
      JJ = JJ+1                                                        2235
      IF (B(JJ).EQ.KEY) GO TO 490                                      2240
      JJ = JJ+1                                                        2245
      IF (B(JJ).EQ.KEY) GO TO 490                                      2250
      JJ = JJ+1                                                        2255
      IF (B(JJ).EQ.KEY) GO TO 490                                      2260
      JJ = JJ+1                                                        2265
      IF (B(JJ).EQ.KEY) GO TO 490                                      2270
      JJ = JJ+1                                                        2275
      IF (B(JJ).EQ.KEY) GO TO 490                                      2280
      JJ = JJ+1                                                        2285
      IF (B(JJ).EQ.KEY) GO TO 490                                      2290
```

```
      JJ = JJ+1                                                          2295
      IF (B(JJ).EQ.KEY) GO TO 490                                        2300
      JJ = JJ+1                                                          2305
      IF (B(JJ).EQ.KEY) GO TO 490                                        2310
      JJ = JJ+1                                                          2315
      IF (B(JJ).EQ.KEY) GO TO 490                                        2320
      JJ = JJ+1                                                          2325
      IF (B(JJ).EQ.KEY) GO TO 490                                        2330
      JJ = JJ-10                                                         2335
      IF (KL.EQ.1) GO TO 500                                             2340
      IF (KL.EQ.2) GO TO 500                                             2345
C      NO KEYBOARD SYMBOL; MAY HAVE FORGOTTEN IT. TEST THE 5TH AND       2350
C      6TH SYMBOLS (IDEPTH).  IF BOTH ARE NINES CALL IT A KEYBOARD.      2355
      IF (B(5).EQ.NINE.AND.B(6).EQ.NINE) GO TO 450                       2360
      GO TO 670                                                          2365
  450 IJJ = JJ+12                                                        2370
      WRITE (6,460) (B(I),I=JJ,IJJ)                                      2375
  460 FORMAT (/5X,'AT 450, MISSING KEY.  B(1) TO B(13)=',13A1/)          2380
      GO TO 500                                                          2385
C                                                                        2390
  470 WRITE (6,480)                                                      2395
  480 FORMAT (5X,'FOUND EIGHT KEYBOARD SYMBOLS IN SEQUENCE.   STOP.')    2400
      GO TO 1570                                                         2405
  490 KL = KL+1                                                          2410
      JJ = JJ+1                                                          2415
C      A CHECK IS MADE HERE FOR MULTIPLE KEYBOARD SYMBOLS. IF NUMBER     2420
C      EXCEEDS EIGHT, PROGRAM TERMINATES. THE NUMBER EIGHT IS ARBITRARY  2425
C      BUT ONE WOULD PROBABLY NOT WANT TO USE A NUMBER GREATER THAN 12   2430
C      (IE. ONE LESS THAN NUMBER OF CHARACTERS IN HEADER). EXPERIENCE    2435
C      INDICATES THAT SELDOM DOES ONE INCUR MORE THAN THREE KEYBOARD     2440
C      SYMBOLS ON A TAPE PER RECORD.                                     2445
      IF (KL.EQ.8) GO TO 470                                             2450
      IF (B(JJ).EQ.STAR) GO TO 670                                       2455
C      TRY AGAIN                                                         2460
      GO TO 440                                                          2465
C                                                                        2470
C      ********************************************************          2475
C      ********** START KEYBOARD DECODE **********                      2480
C                                                                        2485
C      PROCESS KEYBOARD ENTRIES.  CHANGE THE WORDS TO                    2490
C      INTEGER FORM BY SUBTRACTING Z404040F0 AND CREATE MULTI-DIGIT      2495
C      INTEGERS                                                          2500
C      SKIP=T PERMITS NAMELIST DATA TO OVERRIDE HEADING DATA.  ALL THE   2505
C      HEADING DATA MUST THEN BE ON THE NAMELIST CARDS.                  2510
  500 IF (SKIP) GO TO 610                                                2515
      ISTAA = 0                                                          2520
      IDEPT = 0                                                          2525
C      DEFINE INDICES FOR DECODING THE LABEL                             2530
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```
      KY1 = JJ                                                          2530
      KY2 = KY1+2                                                       2535
      KY3 = KY1+3                                                       2540
      KY4 = KY1+4                                                       2545
      KY5 = KY1+5                                                       2550
      KY6 = KY1+6                                                       2555
      KY7 = KY1+7                                                       2560
      KY8 = KY1+8                                                       2565
      KY9 = KY1+9                                                       2570
      KY10 = KY1+10                                                     2575
      KY11 = KY1+11                                                     2580
C                                                                       2585
CCC    DLTREC ARE FOUND HERE IN THE HEADER.  IF DLTREC OCCURS , READ IN 2590
CCCC   A NEW RECORD AND USE SAME CARDS.                                 2595
CCC                                                                     2600
      DO 510 J=KY1,KY10                                                 2605
      IF (B(J).EQ.DLTREC) GO TO 520                                     2610
  510 CONTINUE                                                          2615
C                                                                       2620
C                                                                       2625
      GO TO 550                                                         2630
  520 WRITE (6,530)                                                     2635
  530 FORMAT (/5X,'DLTREC IN HEADER. REPEAT,USING SAME CARDS.'/)        2640
  540 IT = IT+1                                                         2645
      GO TO 200                                                         2650
  550 KT2 = 10                                                          2655
      KS2 = 10                                                          2660
C      THESE TWO STATEMENTS GIVE MAXIMUM VALUES TO KT2 AND KS2 SO THAT  2665
CC     THEY WILL ALWAYS BE DEFINED, EVEN IF  ONLY ONE VARIABLE IS TRACED 2670
CCC                                                                     2675
CCC    DO THE CONVERSION, COMPARE WITH VALUES READ FROM THE CARDS,ACCEPT 2680
CCCC   THE CARDS.                                                       2685
CCC                                                                     2690
C                                                                       2695
      DO 560 J=KY1,KY2                                                  2700
      B(J) = B(J)-ZER                                                   2705
      IB = B(J)                                                         2710
      ISTAA = ISTAA+IB*10**(KY2-J)                                      2715
  560 CONTINUE                                                          2720
C                                                                       2725
      AMONT = B(KY3)                                                    2730
C                                                                       2735
C                                                                       2740
      DO 570 J=KY4,KY5                                                  2745
      B(J) = B(J)-ZER                                                   2750
      IB = B(J)                                                         2755
      IDEPT = IDEPT+IB*10**(J-KY4)                                      2760
                                                                        2765
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```
  570 CONTINUE                                                          2770
C                                                                       2775
      IDSC = B(KY6)-ZER                                                 2780
      ICOD = B(KY7)-ZER                                                 2785
      ITSCL1 = B(KY8)-ZER                                               2790
      ISCL1 = B(KY9)-ZER                                                2795
      IPP = B(KY10)-ZER                                                 2800
C                                                                       2805
C       IF THERE IS A DISAGREEMENT, WRITE A MESSAGE.                    2810
      IF (ISTAA.NE.ISTA) GO TO 590                                      2815
      IF (IDEPT.NE.IDEPTH) GO TO 590                                    2820
      IF (IDSC.NE.IDSCL) GO TO 590                                      2825
      IF (ICOD.NE.ICODE) GO TO 590                                      2830
      IF (ITSCL1.NE.ITSCL) GO TO 590                                    2835
      IF (ISCL1.NE.ISCL) GO TO 590                                      2840
      IF (IPP.NE.IP) GO TO 590                                          2845
  580 FORMAT (5X,'LABEL= 580.  CARD INPUTS EQUALLED TAPE HEADER FOR     2850
     1 STATION ',I3,A1/5X,'IDEPTH= ',I3/)                               2855
      WRITE (6,580) ISTA,AMONC,IDEPTH                                   2860
      GO TO 610                                                         2865
  590 WRITE (6,600) ISTA,AMONC,IDEPTH,IDSCL,ICODE,ITSCL,ISCL,IP,ISTAA,AM  2870
     1ONT,IDEPT,IDSC,ICOD,ITSCL1,ISCL1,IPP                              2875
  600 FORMAT (/3X'CARD AND TAPE DISAGREE, CARD ON TOP'/3X,'   ISTA  AMON  2880
     1C   IDEPTH  IDSCL  ICODE  ITSCL   ISCL    IP'/3X,I7,A7,6I7/3X,I7   2885
     2 ,A7,6I7/)                                                        2890
C       WRITE THE RESULTS                                               2895
  610 WRITE (6,620) ISTA,AMONC,IDEPTH                                   2900
  620 FORMAT (5X,'LABEL 610.  HEADER PROCESSING COMPLETE EXCEPT SEARCH F  2905
     1OR ERRORS ON STATION ',I3,A1/5X,'IDEPTH= ',I3/)                   2910
C                                                                       2915
C                                                                       2920
C       IT IS POSSIBLE THAT NO IRG EXISTS AFTER THE HEADER.IF SO,       2925
C       THE PROGRAM HAS FILLED THE B ARRAY WITH BOTH THE HEADER AND TEMP.  2930
C       OR SALINITY TRACE. ASSUME THERE IS A TRACER SYMBOL IN POSITION  2935
C       12. IF SO, CONTINUE TO PROCESS THE B-ARRAY                      2940
      IF (B(KY11).NE.STAR) GO TO 640                                    2945
      JJJJ = KY11                                                       2950
      WRITE (6,630)                                                     2955
  630 FORMAT (/5X,'NO IRG AFTER HEADER; CONTINUE TO PROCESS B ARRAY.'/)  2960
      GO TO 400                                                         2965
  640 IF (IHDR.EQ.0) GO TO 660                                          2970
C                                                                       2975
C       THIS BRANCH RETURNS TO 150 IF MISSED HEADER AND IHDR SET EQUAL 1.  2980
      WRITE (6,650)                                                     2985
  650 FORMAT (/5X,'HEADER MISSING; INFO INSERTED WITH CARDS.'/)          2990
      IHDR = 0                                                          2995
      GO TO 150                                                         3000
  660 CONTINUE                                                          3005
```

```
      GO TO 1550                                                        3010
C     ************************************************************      3015
C     ********************* END KEYBOARD DECODE *********************      3020
C                                                                       3025
C                                                                       3030
C     ************************************************************      3035
C     ***************** START OF NORMAL TRACE PROCESSING *************      3040
C                                                                       3045
C     THE FOLLOWING PROCEDURE PERMITS THE PRESENCE OF ANY REASONABLE    3050
C     NUMBER OF TRACER SYMBOLS (STAR) INCLUDING NONE.                   3055
  670 NE = 0                                                            3060
      NF = 0                                                            3065
      NSTAR = 0                                                         3070
  680 IF (B(JJ).EQ.STAR) GO TO 700                                      3075
C                                                                       3080
C     COUNT STARS AND WRITE MESSAGE                                     3085
      WRITE (6,690) NSTAR                                               3090
  690 FORMAT (/5X,'START TRACER MODE; NO. OF TRACER SYMBOLS =',I2/)      3095
C     WHEN THERE ARE NO MORE STARS, START TESTING FOR COUNT SYMBOLS ETC  3100
      GO TO 710                                                         3105
  700 JJ = JJ+1                                                         3110
      NSTAR = NSTAR+1                                                   3115
C     WE CONTINUE TO TEST FOR STARS UNTIL NO MORE APPEAR.               3120
      GO TO 680                                                         3125
C                                                                       3130
C     THE NEXT BLOCK OF OPERATIONS TO STATEMENT NO. 950 LOOPS BACK TO   3135
C     710 CONTINUALLY, TESTING EACH CHARACTER FOR IDENTITY AND          3140
C     CONTINUING TO ADD OR SUBTRACT FROM THE CUMULATIVE Y AND X COUNTS  3145
C     UNTIL A DELETE-RECORD SYMBOL OR A STAR OR A DOLLAR INDICATES      3150
C     THE END OF DATA.  THE FLAG IS PLACED AT THE POINT WHERE THE TRACE 3155
C     ENTERS THE CROSS-SECTIONED AREA; PREVIOUS COUNTS RESULT FROM THE  3160
C     TRACER TRAVELLING FROM THE COORDINATE ZERO TO THIS POINT.          3165
  710 IF (B(JJ).EQ.ONE) GO TO 730                                       3170
      IF (B(JJ).EQ.BLANK) GO TO 740                                     3175
      IF (B(JJ).EQ.MINUS) GO TO 750                                     3180
      IF (B(JJ).EQ.FLAG) GO TO 900                                      3185
C     THE NEXT GROUP OF STATEMENTS ALLOW FOR OCCASIONAL COUNTS GREATER  3190
C     THAN + OR - 1.                                                    3195
      IF (B(JJ).EQ.TWO) GO TO 760                                       3200
      IF (B(JJ).EQ.THREE) GO TO 770                                     3205
      IF (B(JJ).EQ.FOUR) GO TO 780                                      3210
      IF (B(JJ).EQ.FIVE) GO TO 790                                      3215
      IF (B(JJ).EQ.SIX) GO TO 800                                       3220
      IF (B(JJ).EQ.SEVEN) GO TO 810                                     3225
      IF (B(JJ).EQ.EIGHT) GO TO 820                                     3230
      IF (B(JJ).EQ.NINE) GO TO 830                                      3235
      IF (B(JJ).EQ.TEN) GO TO 840                                       3240
      IF (B(JJ).EQ.ELEVEN) GO TO 850                                    3245
```

```
      IF (B(JJ).EQ.MTWO) GO TO 860                                          3250
      IF (B(JJ).EQ.MTHREE) GO TO 870                                        3255
      IF (B(JJ).EQ.MFOUR) GO TO 880                                         3260
      IF (B(JJ).EQ.MFIVE) GO TO 890                                         3265
      IF (B(JJ).EQ.DLTREC) GO TO 970                                        3270
      IF (B(JJ).EQ.KEY) GO TO 440                                           3275
  720 FORMAT (//5X,'SYMBOL NOT RECOGNIZED = ',Z8//)                         3280
      WRITE (6,720) B(JJ)                                                   3285
C      IF SYMBOL IS NOT RECOGNIZED, STATION DATA IS NOT PRINTED IF IP=1.    3290
C      PROGRAM BRANCHES AND RE-INITIALIZES ALL VARIABLES FOR PROCESSING     3295
C      NEXT STATION IF IP=1. OTHERWISE, IT RETURNS TO READ NEXT RECORD.     3300
      IF (IP.EQ.1) GO TO 1510                                               3305
      GO TO 1570                                                            3310
  730 RX = 1.                                                               3315
      GO TO 910                                                             3320
  740 RX = 0.                                                               3325
      GO TO 910                                                             3330
  750 RX = -1.                                                              3335
      GO TO 910                                                             3340
  760 RX = 2.                                                               3345
      GO TO 910                                                             3350
  770 RX = 3.                                                               3355
      GO TO 910                                                             3360
  780 RX = 4.                                                               3365
      GO TO 910                                                             3370
  790 RX = 5.                                                               3375
      GO TO 910                                                             3380
  800 RX = 6.                                                               3385
      GO TO 910                                                             3390
  810 RX = 7.                                                               3395
      GO TO 910                                                             3400
  820 RX = 8.                                                               3405
      GO TO 910                                                             3410
  830 RX = 9.                                                               3415
      GO TO 910                                                             3420
  840 RX = 10.                                                              3425
      GO TO 910                                                             3430
  850 RX = 11.                                                              3435
      GO TO 910                                                             3440
  860 RX = -2.                                                              3445
      GO TO 910                                                             3450
  870 RX = -3.                                                              3455
      GO TO 910                                                             3460
  880 RX = -4.                                                              3465
      GO TO 910                                                             3470
  890 RX = -5.                                                              3475
      GO TO 910                                                             3480
  900 JJJ = NE                                                              3485
```

```
      JJ = JJ+1                                                          3490
      FG = 1                                                             3495
      GO TO 710                                                          3500
C                                                                        3505
C      PROGRAM ADDS AND STORES CUMULATIVE SUMS. ONE UNIT EQUALS 0.01     3510
C      INCH.                                                             3515
  910 N = N+1                                                            3520
      NE = N/2                                                           3525
      NF = NE*2                                                          3530
      IF (NF.EQ.N) GO TO 920                                             3535
C      THIS FIDDLING AROUND DETERMINES IF THE COUNT IS EVEN OR ODD.       3540
C      START COUNTING IN THE ORDER YXYX.  X AND Y HAVE NORMAL             3545
C      ORIENTATIONS ON THE STRIP CHART. HOWEVER, X AND Y ARE INVERTED     3550
C      WITH RESPECT TO THE CALMA DIGITIZER. SPECIFICALLY, DEPTH           3555
C      INCREASES ALONG THE POSITIVE X-AXIS AND TEMP AND SALINITY ARE      3560
C      INCREASING FUNCTIONS ALONG THE Y-AXIS ON THE CALMA DIGITIZER.      3565
C      WARNING: DIGITIZE TRACES ACCORDING TO ABOVE ORIENTATION OR BE      3570
C      PREPARED TO RE-DIGITIZE TAPE LATER AFTER DISCOVERING GOOF.         3575
C                                                                        3580
C      IF ODD                                                            3585
      SUMD = SUMD+RX                                                     3590
C      ODD INDEX IS INCREASED TO KEEP IT SAME AS EVEN.                   3595
      NE = NE+1                                                          3600
      Y(NE) = SUMD                                                       3605
      JJ = JJ+1                                                          3610
      GO TO 930                                                          3615
C      IF EVEN                                                           3620
  920 SUMT = SUMT+RX                                                     3625
      X(NE) = SUMT                                                       3630
      JJ = JJ+1                                                          3635
C      IF STAR OR DOLLAR FOUND, END OF DATA HAS BEEN REACHED.            3640
  930 IF (B(JJ).EQ.DLR) GO TO 990                                        3645
C      ********************************************************          3650
C      ********** END OF NORMAL TRACE PROCESSING **********             3655
C                                                                        3660
C                                                                        3665
C      ********************************************************          3670
C      ********** BEGIN TROUBLE-SHOOTING **********                     3675
C      IF THERE IS NO IRG AT END OF HEADER BUT THERE IS A TRACER SYMBOL,  3680
C      THE PROGRAM SEPARATES THE TWO RECORDS BY FIRST SETTING NOIRG=1     3685
C      AND PROCESSING FIRST PART OF B-ARRAY AND THEN READING A NEW SET    3690
C      OF CARDS TO PROCESS SECOND PART OF B-ARRAY.                       3695
      IF (B(JJ).NE.STAR) GO TO 950                                       3700
      NOIRG = 1                                                          3705
C      SAVE THE INDEX OF THE START OF THE SECOND HALF, JJJJ.             3710
      JJJJ = JJ                                                          3715
      WRITE (6,940)                                                      3720
  940 FORMAT (/5X,'FOUND A STAR AT END OF TRACER ASSUME THERE IS NO IRG.  3725
```

```
     1'/5X,'PROCESS RECORD IN TWO PARTS, READING CARDS FOR BOTH PARTS.'/     3730
     2)                                                                      3735
      GO TO 990                                                              3740
  950 IF (B(JJ).NE.KEY) GO TO 710                                            3745
      JJJJ = JJ                                                              3750
      WRITE (6,960)                                                          3755
  960 FORMAT (/5X,'FOUND A KEYBOARD SYMBOL.  PROCESS NEXT PORTION OF B-A     3760
     1RRAY AFTER READING NEW CARDS.'/)                                       3765
      NOIRG = 1                                                              3770
      GO TO 990                                                              3775
C                                                                            3780
  970 WRITE (6,980) JJ                                                       3785
  980 FORMAT (5X,'FOUND DELETE RECORD SYMBOL AT JJ= ',I5)                    3790
C      IF DELETE RECORD FOUND, PROGRAM INCREMENTS RECORD COUNT,IT,           3795
C      AND RESTARTS PROCESSING BUT DOES NOT READ A NEW PAIR OF CARDS.        3800
      GO TO 540                                                              3805
  990 JJ = JJ-1                                                              3810
CCC                                                                          3815
CCC    ********************************************************************  3820
CCC    ********** END TRACER AND ASSOCIATED TROUBLE-SHOOTING **************  3825
CCC                                                                          3830
CCC    UP TO THIS POINT, PROCESSING IS IDENTICAL FOR S AND T.                3835
C      START CONVERTING T AND D TO SCIENTIFIC UNITS                          3840
      WRITE (6,1000) JJJ,NE,Y(NE),X(NE)                                      3845
 1000 FORMAT (/5X,'LABEL 1000. START CONDENSING UNCONVERTED ARRAY AND CO     3850
     1NVERTING TO SCIENTIFIC UNITS.'/5X,'THE TRACER ENTERED THE FRAME (F     3855
     2LAG) AT JJJ= ',I5/5X,'THE END OF THE TRACE HAS INDEX NE= ',I5/         3860
     3 5X,'LAST (UNCONVERTED) DEPTH AND TEMP ARE: ',F7.1,2X,F7.1/)           3865
C                                                                            3870
CCC                                                                          3875
C      CHECK TO SEE IF FLAG WAS FOUND.                                       3880
      IF (FG.EQ.1) GO TO 1020                                                3885
      WRITE (6,1010)                                                         3890
 1010 FORMAT (/5X,'NO FLAG FOUND; PROCESS ANYWAY.'/)                         3895
 1020 WRITE (6,1030)                                                         3900
 1030 FORMAT (' ')                                                           3905
      FG = 0                                                                 3910
C                                                                            3915
CCC    THE X AND Y ARRAYS ARE FILLED AND THE START AND END OF THIS BATCH     3920
CCC    OF DATA ARE LABELLED WITH JJJ AND NE.                                 3925
CCC    CONVERT THE ARRAYS INDEXED ON 0.01-INCH DEPTH SPACINGS.               3930
CCC    SUBROUTINE CONDNS SERVES THIS PURPOSE ALTHOUGH IT NO LONGER           3935
CCC    CONDENSES  A SECOND ARRAY TO SMALLER SIZE, NOR DOES IT PAD THE        3940
CCC    GAP BETWEEN ARRAYS, BUT WITHIN ONE SEGMENT, IT DOES INTERPOLATE       3945
CCC    TO FILL ANY BLANK ARRAY POSITIONS.                                    3946
CCC                                                                          3950
CCC                                                                          3955
C      TO THOSE FAMILIAR WITH EARLIER VERSIONS OF THIS PROGRAM, THE          3960
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C       FOLLOWING CONDENSE ROUTINES WILL NOT EVEN APPEAR REMOTELY                3965
C       SIMILAR. THE EARLIER VERSION HAD TO BE EXTENSIVELY MODIFIED              3970
C       TO PERMIT MULTIPLE DEPTH SCALES. SPECIFICALLY, WHEN USING                3975
C       MULTIPLE DEPTH SCALES ONE'S DEPTH AXIS REFERENCE CHANGES AND             3980
C       CONSEQUENTLY IN CONSTRUCTING THE S AND D OR T AND D ARRAYS               3985
C       THIS ROUTINE WORKS WELL.                                                 3990
        IF (ICODE.EQ.0) GO TO 1080                                               3995
C   *                                                                   *        4000
C   S***********************************************************************S    4005
C       CONDENSE THE X AND Y ARRAYS INTO S AND D                                 4010
C   S***********************************************************************S    4015
C   *                                                                   *        4020
        KS = KS+2                                                                4025
        KS1 = KS-1                                                               4030
        KS2 = KS+1                                                               4035
        IF (IDSCL.EQ.1) GO TO 1040                                               4040
        KDT1 = KSCARF+1                                                          4045
        GO TO 1050                                                               4050
 1040   KDT1 = INSA(KS1)                                                         4055
 1050   CALL CONDNS (X,Y,S1,JJJ,NE,KDT1,KDTH1,KDTH2)                             4060
        KDTA = KDTH1+1                                                           4065
        K = KDTH1                                                                4070
        IF (IDSCL.EQ.1) GO TO 1060                                               4075
        K = KDT1                                                                 4080
C                                                                                4085
C                                                                                4090
 1060   DO 1070 J=KDTH1,KDTH2                                                    4095
        D(K) = (J-1)/DCON(IDSCL)+CORD                                            4100
        S(K) = S1(J)/SCON+CORRS(ISCL)+SCOR                                       4105
        K = K+1                                                                  4110
        KSCARF = K                                                               4115
 1070   CONTINUE                                                                 4120
C                                                                                4125
C                                                                                4130
        INSA(KS) = KDTH1                                                         4135
        INSA(KS2) = KDTH2                                                        4140
        GO TO 1130                                                               4145
C   *                                                                   *        4150
C   T***********************************************************************T    4155
C       CONDENSE THE X AND Y ARRAYS INTO T AND D                                 4160
C   T***********************************************************************T    4165
C   *                                                                   *        4170
 1080   KT = KT+2                                                                4175
        KT1 = KT-1                                                               4180
        KT2 = KT+1                                                               4185
        IF (IDSCL.EQ.1) GO TO 1090                                               4190
        KDT1 = KBARF+1                                                           4195
        GO TO 1100                                                               4200
```

```
 1090 KDT1 = INTA(KT1)                                                          4205
 1100 CALL CONDNS (X,Y,T1,JJJ,NE,KDT1,KDTH1,KDTH2)                              4210
      KDTA = KDTH1+1                                                            4215
      K = KDTH1                                                                 4220
      IF (IDSCL.EQ.1) GO TO 1110                                                4225
      K = KDT1                                                                  4230
C                                                                               4235
C                                                                               4240
 1110 DO 1120 J=KDTH1,KDTH2                                                     4245
      D(K) = (J-1)/DCON(IDSCL)+CORD                                             4250
      T(K) = T1(J)/TCON+CORRT(ITSCL)+TCOR                                       4255
      K = K+1                                                                   4260
      KBARF = K                                                                 4265
 1120 CONTINUE                                                                  4270
C                                                                               4275
C                                                                               4280
      INTA(KT) = KDTH1                                                          4285
      INTA(KT2) = KDTH2                                                         4290
C   *                                                                   *       4295
C   T*******************************************************************T       4300
 1130 CONTINUE                                                                  4305
C
C      ************************************************************************
C      ********************** HAND-ENTERED DATA ***********************
C
C      CONVERSION OF X AND Y ARRAYS INTO T AND S ARRAYS IS COMPLETE.            4310
C      AT THIS POINT, SURFACE AND NEAR-SURFACE DATA WILL BE INSERTED.           4315
C      NORMALLY, ONLY SURFACE VALUES NEED TO BE INSERTED DUE TO THE             4320
C      DIGITIZER OPERATOR BEGINNING TO TRACE SLIGHTLY BELOW HIS ZERO            4325
C      DEPTH REFERENCE POINT. SURFACE DATA VALUES ARE INSERTED BY               4330
C      CHECKING THE VALUE OF IH. IF IH=0, DATA IS NOT INSERTED. IF IH=1,        4335
C      SURFACE DEPTH,TEMP, AND SALINITY VALUES ARE INSERTED VIA &DAT            4340
C      DATA CARD FOR PARTICULAR STATION.                                        4345
C      CAUTION: HAND-ENTERED DATA VALUES SHOULD BE CORRECTED VALUES             4350
C      IF CORRECTIONS,TCOR AND SCOR, ARE APPLICABLE.                            4355
C      INFREQUENTLY, DATA VALUES BELOW THE SURFACE MUST BE INSERTED.            4360
C      PROVISION IS MADE FOR NEAR-SURFACE DEPTHS DOWN TO APPROXIMATELY          4365
C      15 METERS. THIS OCCURS DUE TO THE SAME REASON AS ABOVE(IE. A NOT         4370
C      SO METICULOUS OPERATOR BEGAN DIGITIZING BELOW ZERO REFERENCE             4375
C      POINT.). SINCE THIS OCCURS SELDOM, AND INVOLVES A SIGNIFICANT            4380
C      AMOUNT OF LABOR TO MANUALLY READ THE STD TRACE, CORRECT THE              4385
C      VALUES IF NEEDED AND PLACE ON &DAT CARD, THIS OPERATION WILL             4390
C      ONLY BE DONE FOR FINAL OUTPUT TO TAPE,CARD OR PRINTER.                   4395
C      CONSEQUENTLY, TO INSERT NEAR-SURFACE DATA ISQZ MUST EQUAL 1,             4400
C      IH MUST BE GREATER THAN OR EQUAL TO 2. DH,TH, AND SH WERE                4405
C      DIMENSIONED AT 50. THIS EQUATES TO APPROXIMATELY 15 METERS.              4410
C      ISQZ=1 WAS CHOSEN AS DETERMINING VALUE DUE ALL ELEMENTS OF D,T,          4415
C      AND S ARRAYS ARE PRINTED OUT VIA OUT1. THIS ELIMINATES                   4420
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C       'GUESSWORK' OF WHICH VALUES SHOULD BE INSERTED. IN OTHER WORDS,      4425
C       ALL OF THEM ARE INSERTED.                                            4430
        IF (IH.EQ.0) GO TO 1150                                              4435
        S(1) = SH(1)                                                         4440
        T(1) = TH(1)                                                         4445
        IF (IH.LT.2) GO TO 1150                                              4450
        IF (ISQZ.GT.1) GO TO 1150                                            4455
C                                                                            4460
C                                                                            4465
        DO 1140 J=2,IH                                                       4470
        S(J) = SH(J)                                                         4475
        T(J) = TH(J)                                                         4480
        D(J) = DH(J)                                                         4485
 1140 CONTINUE                                                               4490
C                                                                            4495
C                                                                            4500
 1150 CONTINUE                                                               4505
C   *                                                                    *   4510
C--------------------                                                        4515
        IPLACE=1155                                                          4520
        WRITE (6,210) (D(J),J=1,1801,20)                                     4525
        WRITE (6,210) (T(J),J=1,1801,20),IPLACE                              4530
        WRITE (6,210) (S(J),J=1,1801,20),IPLACE                              4535
        WRITE (6,220) (INSA(J),J=1,10)                                       4540
        WRITE (6,230) (INTA(J),J=1,10)                                       4545
        WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J  4550
       1JJJ                                                                  4555
C--------------------                                                        4560
C                                                                            4565
        IF (IP.EQ.1) GO TO 1160                                              4570
        IF (NOIRG.EQ.1) GO TO 400                                            4575
        GO TO 1570                                                           4580
 1160 IN1 = KBARF                                                            4585
        IN2 = KSCARF                                                         4590
        KDTA = MIN0(IN1,IN2)                                                 4595
 1170 FORMAT (5X,'LABEL=1170.',3I7//)                                        4600
        WRITE (6,1170) IN1,IN2,KDTA                                          4605
C       ************************************************************         4610
C       ********** EDITING OF UNWANTED ZERO DATA VALUES **********          4615
C                                                                            4620
C       IN DIGITIZING TEMP AND SALINITY SEGMENTS OF TRACES ONE CAN NOT       4625
C       AVOID GETTING GAPS SOMETIMES BETWEEN TRACE SEGMENTS. WHEN THIS       4626
C       HAPPENS THE OUTPUT PRINTOUT WILL SHOW -5.0 AND 0.0 FOR THE           4630
C       TEMPERATURE AND SALINITY VALUES RESPECTIVELY. THESE VALUES ARE       4635
C       THE PRE-INITIALIZED VALUES OF THE T AND S ARRAYS, AND INDICATE       4640
C       NO ATTEMPT HAS BEEN MADE TO PLACE DATA IN THE PARTICULAR ARRAY       4645
C       POSITION (IE A GAP IN DATA). IT IS DESIRABLE THAT THESE UNWANTED     4650
C       VALUES OR GAPS BE ELIMINATED PRIOR TO WRITING A TAPE OR PUNCHING     4655
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C       A CARD. THUS A CHECK IS MADE TO SEE IF T(J) OR S(J) ARE -5.0 OR
C       0.0 RESPECTIVELY. IF T(J) AND S(J) ARE NOT -5.0 OR 0.0
C       RESPECTIVELY, THE VALUES ALONG WITH DEPTH ARE PLACED INTO D2,T2,
C       AND S2 ARRAYS. IF GAPS DO EXIST, THE VALUES ARE WRITTEN OUT AND
C       COUNTED BUT NOT PUT INTO THE D2,T2,AND S2 ARRAYS.  THIS PROCESS
C       IN EFFECT DISCARDS THE GAPS IN THE DATA. THE D,T, AND S ARRAYS
C       ARE THEN RE-INITIALIZED, AND THE D2,T2,AND S2 ARRAYS ARE PUT BACK
C       INTO THE D,T,AND S ARRAYS. NOTE, THE VALUE OF KDTA WHICH
C       IS EQUAL TO TOTAL NUMBER OF RECORDS IS REDUCED BY NUMBER OF
C       UNWANTED RECORDS BY MAKING USE OF THE VARIABLE KDTAF.
      K = 0
      L = 1
C
C
      DO 1200 J=1,KDTA
      IF ((T(J).EQ.-5.0).OR.(S(J).EQ.0.0)) GO TO 1180
      D2(L) = D(J)
      T2(L) = T(J)
      S2(L) = S(J)
      L = L+1
      GO TO 1200
 1180 WRITE (6,1190) D(J),T(J),S(J),J
      K = K+1
      JSAV = K
 1190 FORMAT (//5X,3F7.2,I6,//)
 1200 CONTINUE
C
C
 1210 FORMAT (//5X,' JSAV=',I6,//)
      WRITE (6,1210) JSAV
      KDTAF = KDTA-JSAV
      KDTA = KDTAF
C
C
      DO 1220 J=1,1801
      D(J) = 0.0
      T(J) =-5.0
      S(J) = 0.0
 1220 CONTINUE
C
C
C
C
      DO 1230 J=1,KDTA
      D(J) = D2(J)
      T(J) = T2(J)
      S(J) = S2(J)
 1230 CONTINUE
```

```
C                                                                       4880
CCCC                                                                    4885
CCCC     ************************************************************   4890
CCCC     ****************** SOUND VELOCITY AND SIGMA-T ****************   4895
CCCC                                                                    4900
C       PRODUCE SOUND VELOCITY AND SIGMA-T WHEN IP.EQ.1                 4905
      CALL SVEL (D,T,S,SV,KDTA)                                         4910
      CALL SIGMT (S,T,SIG,KDTA)                                         4915
C                                                                       4920
CCCC     ************************************************************   4925
CCCC     ************ CONSECUTIVE RECORD SERIALIZATION ROUTINE ***********4930
CCCC                                                                    4935
CCCC     ARRAYS ARE COMPLETE AT THIS POINT FROM INDEX 1 TO THE END OF   4940
CCCC     THE SMALLER OF THE SALINITY OR TEMPERATURE ARRAYS.             4945
C       GENERATE SERIAL NUMBERS FOR THE RECORDS.                        4950
      IF (JREC.GT.18) GO TO 1240                                        4955
      JREC = 1                                                          4960
 1240 CONTINUE                                                          4965
C                                                                       4970
CC                                                                      4975
      DO 1250 J=1,KDTA                                                  4980
      JREC = JREC+1                                                     4985
      IREC(J) = JREC                                                    4990
 1250 CONTINUE                                                          4995
C                                                                       5000
CCCC                                                                    5005
CCCC     ************************************************************   5010
CCCC     ************************  O U T P U T  ************************   5015
CCCC                                                                    5020
CCCC                                                                    5025
CCCC     THIS SECTION CONVERTS THE LETTER DESIGNATOR FOR MONTH(AMONC) FROM5030
CCCC     THE SINGLE LETTER CODE ON THE DIGITIZED TAPE TO THE APPROPRIATE 5035
CCCC     MONTH AND YEAR IN PREPARATION FOR WRITING THE OUTPUT.          5040
CCCC                                                                    5070
C                                                                       5075
      DO 1260 J=1,13                                                    5080
      IF (AMONC.EQ.AMONCA(J)) GO TO 1280                                5085
 1260 CONTINUE                                                          5090
C                                                                       5095
CC                                                                      5100
 1270 FORMAT (15X,'AMONC NEVER DID EQUAL AMONC(J).  CONSEQUENTLY,       5105
     1WMONTH WILL NOT BE DEFINED.'/)                                    5110
      WRITE (6,1270)                                                    5115
      GO TO 1290                                                        5120
 1280 WMONTH = EVENT(J)                                                 5125
 1290 CONTINUE                                                          5130
C                                                                       5135
C     ************************************************************      5140
```

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C       ************** OCEANOGRAPHIC DATA STATION SUMMARIES *************
C
      IF (.NOT.PRT1) GO TO 1300
C
C       PRINT DATA
      WRITE (6,1560)
C       THE PARAMETER ISQZ PERMITS CONDENSING THE PRINTED DATA BY THE
C       FACTOR ISQZ
      CALL OUTI (D,T,S,SV,SIG,KDTA,ISTA,WMONTH,IREC,JREC,ISQZ)
C
C       ***********************************************************
C       ************************** WRITE TAPE *********************
C
 1300 IF (.NOT.TAPE) GO TO 1340
C       TAPE MUST BE TRUE ONLY ONCE, AT THE BEGINNING OF TAPE  WRITING.
C       WRITE HEADER STATION LABEL HERE.
      WRITE (8,1310) ISTA,WMONTH,KDTA
 1310 FORMAT (I5,A12,I6,17X)
      WRITE (8,1320) (D(J),T(J),S(J),SV(J),SIG(J),J=1,KDTA)
 1320 FORMAT (F6.2,2F6.3,F7.2,F7.4,8X)
C       LRECL WILL BE 40 DIGITS IN LENGTH. PROVIDE APPROPRIATE JCL.
      WRITE (6,1330) ISTA,WMONTH,JREC
 1330 FORMAT (5X,'DATA FOR STATION ',I5,A12,' WRITTEN ON TAPE UP TO
     1 RECORD ',I6)
C
C       ***********************************************************
C       ******************* DATA CARD PUNCH ROUTINE ***************
C
 1340 IF (.NOT.CARDS) GO TO 1430
C
C       PUNCHED DATA IS COMPRESSED BY FACTOR ICSQZ. FORMAT FOR TWO
C       DATA SETS ON A CARD.  KCRD BECOMES THE NUMBER OF DATA PRINTED IF
C       IT IS EVENLY DIVISIBLE. OTHERWISE, LAST DATUM POINT IS PUNCHED.
C       SUPPLY JCL FOR CARD PUNCHING
      KCRD = KDTA/ICSQZ
      NCRDS = KCRD/2
      IDIF = KCRD-2*NCRDS
      IF (IDIF.EQ.0) GO TO 1360
      KCRD = KCRD+1
 1350 FORMAT (24X,'OCEANOGRAPHIC DATA FROM U C M II',//)
 1360 WRITE (7,1350)
      WRITE (7,1370) KCRD,ISTA,WMONTH,ICSQZ
 1370 FORMAT (1X,I4,' VALUES OF D,T,S,SV,SIGMT FOR STATION ',I4,A12,
     1 '  COMPRESSED BY  ',I3,/)
 1380 FORMAT (2X,'DEPTH',3X,'TEMP.',1X,'SALNTY.',1X,'SND.VEL.',1X,
     1 'SIGMA-T',3X,'DEPTH',2X,'TEMP.',1X,'SALNTY.',1X,'SND.VEL.',1X,
     2 'SIGMA-T')
 1390 FORMAT (2X,'METERS',2X,'DEG.C.',1X,'PPT.',4X,'M/SEC',13X,'METERS',
```

```
     1 1X,'DEG.C.',1X,'PPT.',4X,'M/SEC',10X,/)                                  5385
       WRITE (7,1380)                                                           5390
       WRITE (7,1390)                                                           5395
       ICS2 = ICSQZ*2                                                           5400
       J = 1                                                                    5405
       K1 = 1                                                                   5410
       KK = ICSQZ                                                               5415
 1400  FORMAT (1X,3F7.2,F9.2,F8.3,3X,3F7.2,F9.2,F8.3)                           5420
       WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1),D(KK),T(KK),S(KK),       5425
      1SV(KK),SIG(KK)                                                           5430
       J = 3                                                                    5435
 1410  IF (J.GT.NCRDS) GO TO 1420                                               5440
       K1 = (J-1)*ICS2                                                          5445
       KK = K1+ICSQZ                                                            5450
       WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1),D(KK),T(KK),S(KK),       5455
      1SV(KK),SIG(KK)                                                           5460
       J = J+1                                                                  5465
       GO TO 1410                                                               5470
 1420  IF (IDIF.EQ.0) GO TO 1430                                                5475
       K1 = KDTA                                                                5480
       WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1)                          5485
C                                                                               5490
CCCC    ************************************************************           5495
CCCC    ************** HYDROGRAPHIC PROGRAM CARD PUNCH ***************           5500
C                                                                               5505
 1430  IF (.NOT.GCARDS) GO TO 1500                                              5510
       GCRD = KDTA/IGSQZ                                                        5515
       WRITE (7,1350)                                                           5520
 1440  FORMAT (1X,I4,' VALUES OF D , T , AND S  FOR STATION ',I4,A12,           5525
      1 '   COMPRESSED BY  ',I3,/)                                             5530
       WRITE (7,1440) GCRD,ISTA,WMONTH,IGSQZ                                    5535
 1450  FORMAT (2X,'DEPTH',7X,'TEMP.',4X,'SALINITY',15X,'STATION',4X,'DATE       5540
      1',5X,'VALUE',9X)                                                         5545
 1460  FORMAT (2X,'METERS',6X,'DEG.C.',5X,'PPT.',51X,/)                         5550
       WRITE (7,1450)                                                           5555
       WRITE (7,1460)                                                           5560
       J = 1                                                                    5565
       K1 = 1                                                                   5570
 1470  FORMAT (1X,F7.1,2X,F9.2,1X,F10.3,18X,I3,A12,'  K1=',I4,I8)               5575
       WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J                        5580
       J = 2                                                                    5585
 1480  K1 = (J-1)*IGSQZ                                                         5590
       IF (K1.GE.KDTA) GO TO 1490                                               5595
       WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J                        5600
       J = J+1                                                                  5605
       IF (J.GE.500) GO TO 1500                                                 5610
       GO TO 1480                                                               5615
 1490  K1 = KDTA                                                                5620
```

```
      WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J                  5625
C                                                                        5630
CCCCC                                                                    5635
CCCCC  ***************************************************************  5640
CCCCC  JREC IS INCREMENTED HERE BY 1 TO ACCOUNT FOR TAPE ID LABEL FOR    5645
CCCCC  NEXT STATION TO BE PROCESSED.  THIS KEEPS SERIALIZATION OF        5650
CCCCC  RECORDS ON TAPE CONSECUTIVE AND INCLUDES LABELS FOR EACH STATION. 5655
 1500 JREC = JREC+1                                                      5660
CCCCC  ***************************************************************  5665
CCC                                                                      5670
CCC                                                                      5675
 1510 IF (ENDFL) END FILE 8                                              5680
CCCCC                                                                    5685
CCCCC  NORMALLY, ENDFL MUST BE TRUE ONCE ON THE LAST TAPE WRITING        5690
CCCCC  OPERATION. HOWEVER, IT IS NOT REQUIRED BY IBM.  IT IS WRITTEN     5695
CCCCC  ALWAYS AFTER LAST TAPE WRITING OPERATION WITHOUT COMMAND.         5700
CCCCC                                                                    5705
CCCCC  ***************************************************************  5710
CCCCC  ******** INITIALIZE VARIABLES AND ARRAYS FOR NEXT STATION *******  5715
CCC                                                                      5720
C                                                                        5725
      DO 1520 J=1,1801                                                   5730
      D(J) = 0.0                                                         5735
      T(J) =-5.0                                                         5740
      S(J) = 0.0                                                         5745
      D2(J) = 0.0                                                        5750
      T2(J) =-5.0                                                        5755
      S2(J) = 0.0                                                        5760
      T1(J) =-5.0                                                        5765
      S1(J) = 0.0                                                        5770
      IREC(J) = 0                                                        5775
 1520 CONTINUE                                                           5780
C                                                                        5785
CC                                                                       5790
      INSA(1) = 1                                                        5795
      INSA(2) = 1                                                        5800
      INTA(1) = 1                                                        5805
      INTA(2) = 1                                                        5810
      KBARF = 0                                                          5815
      KSCARF = 0                                                         5820
C                                                                        5825
CC                                                                       5830
      DO 1530 J=3,10                                                     5835
      INSA(J) = 980                                                      5840
      INTA(J) = 980                                                      5845
 1530 CONTINUE                                                           5850
C                                                                        5855
CC                                                                       5860
```

```
      KS = 1                                                                5865
      KT = 1                                                                5870
C                                                                           5875
C                                                                           5880
      DO 1540 J=1,50                                                        5885
      SH(J) = 0.0                                                           5890
      TH(J) =-5.0                                                           5895
      DH(J) = 0.0                                                           5900
 1540 CONTINUE                                                              5905
C                                                                           5910
C                                                                           5915
      SKIP = .FALSE.                                                        5920
      JSAV = 0                                                              5925
      KDTAF = 1                                                             5930
      IDEPTH = 0                                                            5935
      IH = 0                                                                5940
      IP = 0                                                                5945
      IF (NOIRG.EQ.1) GO TO 400                                             5950
      GO TO 1570                                                            5955
C                                                                           5960
C     ***************************************************************       5965
C     ************************* R E T U R N *************************       5970
C                                                                           5975
 1550 CONTINUE                                                              5980
 1560 FORMAT ('1')                                                          5985
 1570 IT = IT+1                                                             5990
      GO TO 150                                                             5995
 1580 STOP                                                                  6000
      END                                                                   6005
```

```
C      ----------------SUBROUTINE OUT1 MOD1,JUNE 1975--------------------
       SUBROUTINE OUT1 (D,T,S,SV,SIG,N,ISTA,WMONTH,IREC,JREC,ISQZ)
       REAL *8WMONTH
       DIMENSION D(1), T(1), S(1), SV(1), SIG(1), IREC(1)
C        PRODUCE HEADING
    20 WRITE (6,30) ISTA,WMONTH,ISQZ
    30 FORMAT (//T38,'OCEANOGRAPHIC DATA FROM U C M II'//T41,'STATION ',
      1 I3,A12/T41,'COMPRESSED BY FACTOR ',I3///)
C        FORMAT FOR PRINTING TWO BLOCKS OF DATA PER PAGE.
       WRITE (6,40)
    40 FORMAT (T6,'DEPTH',T14,'TEMP.',T20,'SALNTY.',T28,'SND.VEL.',T36,'
      1 SIGMA-T',T48,'DEPTH',T56,'TEMP.',T62,'SALNTY.',T70,'SND.VEL.',
      2 T80,'SIGMA-T')
       WRITE (6,50)
    50 FORMAT (T6,'METERS',T14,'DEG.C.',T21,'PPT.',T29,'M/SEC',T48,
      1 'METERS',T56,'DEG.C.',T63,'PPT.',T71,'M/SEC'/)
       NN = N/2
       NO = N-2*NN
C
C
       DO 60 J=1,NN,ISQZ
       K = NN+J
       WRITE (6,70) D(J),T(J),S(J),SV(J),SIG(J),D(K),T(K),S(K),SV(K),SIG(
      1K),IREC(J),IREC(K)
    60 CONTINUE
C
CC
    70 FORMAT (T6,F5.1,T14,F5.2,T21,F5.2,T28,F7.2,T39,F6.3,T48,F5.1,T56,F
      15.2,T63,F5.2,T70,F7.2,T81,F6.3,T90,2I8)
       IF (NO.EQ.0) GO TO 90
       WRITE (6,80) D(N),T(N),S(N),SV(N),SIG(N),IREC(N)
    80 FORMAT (T48,F5.1,T56,F5.2,T63,F5.2,T70,F7.2,T81,F6.3,T90,8X,I8)
    90 WRITE (6,100)
   100 FORMAT ('1')
       RETURN
       END
```

```
C       ---------------------- SUBROUTINE CHMOVE ----------------------
      SUBROUTINE CHMOVE (A,I,B,J)
C       THIS SUBROUTINE RETURNS A LOGICAL*1 VARIABLE TO A 4-BYTE ADDRESS
C       IN THE MAIN PROGRAM, UNPACKING THE ORIGINAL 4-BYTE WORDS A
C       BYTE AT A TIME.
      LOGICAL *1A(1),B(1)
      B(J) = A(I)
      RETURN
      END
```

```
C       ---------------SUBROUTINE SVEL MOD.1,JUNE 73---------------
      SUBROUTINE SVEL (AA,BB,CC,SV,K1)
C       THIS COMPUTES SOUND VELOCITY FROM DEPTH, TEMPERATURE AND SALINITY
C       ACCORDING TO WILSON'S EQUATION
      DIMENSION AA(1), BB(1), CC(1), SV(1)
C
C
      DO 30 J=1,K1
      Z = AA(J)
      T = BB(J)
      S = CC(J)
      IF (T.LT.-1.99.OR.S.LT.0.1) GO TO 20
      P = .1027*Z+1.282E-7*Z*Z
      T2 = T*T
      T3 = T2*T
      VT = 4.5721*T-4.4532E-2*T2-2.6045E-4*T3+7.9851E-6*T3*T
      P2 = P*P
      P3 = P2*P
      P4 = P2*P2
      VP = .160272*P+1.0268E-5*P2+3.5216E-9*P3-3.3603E-12*P4
      SR = S-35.
      VS = 1.39799*SR+1.69202E-3*SR*SR
      VSTP = SR*(-1.1244E-2*T+7.7711E-7*T2+7.7016E-5*P-1.2943E-7*P2+3.15
     180E-8*P*T+1.579E-9*P*T2)+P*(-1.8607E-4*T+7.4812E-6*T2+4.5283E-8*T3
     2)+P2*(-2.5294E-7*T+1.8563E-9*T2)+P3*(-1.9646E-10*T)
      SV(J) = 1449.14+VT+VP+VSTP+VS
      GO TO 30
   20 SV(J) = 0.
   30 CONTINUE
C
C
      RETURN
      END
```

```
C       ------------------------ SUBROUTINE SIGMT ---------------------
      SUBROUTINE SIGMT (AA,BB,SIG,K1)
C      THIS SUBROUTINE COMPUTES SIGMA-T FROM SALINITY AND
C      TEMPERATURE ACCORDING TO H.O.614 P.91
      DIMENSION AA(1), BB(1), SIG(1)
C
C
      DO 30 J=1,K1
      S = AA(J)
      T = BB(J)
      IF (T.LT.-1.99.OR.S.LT.0.1) GO TO 20
      CL = (S-0.03)/1.805
      B = T*(18.03-0.8164*T+0.01667*T**2)*10.**(-6)
      A = T*(4.7867-0.098185*T+0.0010843*T**2)*10.**(-3)
      SG = -0.069+1.4708*CL-0.001570*CL**2+0.0000398*CL**3
      SGA = -((T-3.98)**2/503.57)*((T+283)/(T+67.26))
      SIG(J) = SGA+(SG+0.1324)*(1-A+B*(SG-0.1324))
      GO TO 30
   20 SIG(J) = 0.
   30 CONTINUE
C
C
      RETURN
      END
```

```
C      ------------------------ SUBROUTINE CONDNS ----------------------
       SUBROUTINE CONDNS (X,Y,T1,JJJ,NE,KDT1,KDTH1,KDTH2)
C
CC      SUBROUTINE CONDNS MOD. 3,17 SEPT 74  BY R. G. PAQUETTE.
CC
CC      THIS SUBROUTINE FINDS THE ARRAY LOCATIONS FOR X, INDEXED
CC      SEQUENTIALLY FOR EACH UNIT OF Y.  EACH UNIT OF Y IS 1.0 AND
CC      CORRESPONDS TO .01 INCHES OF TRAVEL IN THE DEPTH DIRECTION.
CC      MOD. 3 FILLS IN BLANK ARRAY POSITIONS DUE TO THE DIGITIZER STEPP-
CC      ING AHEAD MORE THAN .01 INCHES AT A STEP AND WRITES A MESSAGE
C       ON THE PRINTER.
       DIMENSION X(1), Y(1), T1(1), KINS(10), KNO(10)
C
CC      IF FIRST INDEX IS ZERO OR NEGATIVE THERE IS A MISBEHAVIOR ELSE-
C       WHERE IN THE PROGRAM.  RESET JJJ TO 1.
       IF (JJJ.GE.1) GO TO 30
       JJJ = 1
       WRITE (6,20)
   20  FORMAT (/5X,'****** JJJ RESET TO ONE - SOMETHING WRONG ******'/)
C       KDTH1 BECOMES THE INDEX OF THE START OF THIS ARRAY SEGMENT.
   30  KDTH1 = Y(JJJ)+1.50
C       IF KDTH1 BECOMES ZERO OR LESS(THE ORIGIN OF MEASUREMENT IS
CC      POSITIVE WITH RESPECT TO THE START OF TRACE), USE THE START
CC      OF THE CURVE AS THE ORIGIN OF INDEXING.
C       THIS CAUSES AN OVERLAP BETWEEN ARRAYS, BUT IT SHOULD BE SMALL.
       XINC = 0.
       IF (KDTH1.GT.0) GO TO 40
       XINC = FLOAT(1-KDTH1)
       KDTH1 = 1
C
   40  JJ1 = JJJ+1
       NE1 = NE-1
C       FORM SUBSCRIPTS FROM THE DEPTH INCREMENTS AND STORE X'S AT THOSE
CC      ARRAY LOCATIONS.
CC      SEARCH FOR BLANKS IN ARRAY BETWEEN INDEXES KDTH1 AND KDTH2.
C       KCT COUNTS THE NUMBER OF BLANKS
       KCT = 0
       KSAV = KDTH1
C       KINS(J) IS THE NUMBER OF THE ARRAY POSITION FILLED.
CC
C
       DO 50 J=1,10
       KNO(J) = 0
   50  KINS(J) = 0
C
CCC
CCC
C
```

```
      DO 80 J=JJ1,NE1                                                    245
      KDTH = Y(J)+1.50+XINC                                              250
      T1(KDTH) = X(J)                                                    255
C      TEST TO SEE IF INDEX IS THE SAME OR ONE GREATER THAN THE LAST     260
C      ONE.  IF NOT, INTERPOLATE VALUES.                                 265
      NREP = KDTH-KSAV                                                   270
      IF (NREP.LE.1) GO TO 70                                            275
      KCT = KCT+1                                                        280
      IF (KCT.GT.10) KCT = 10                                            285
      KNO(KCT) = NREP                                                    290
      KINS(KCT) = KDTH                                                   295
      II = KSAV+1                                                        300
      III = KDTH-1                                                       305
      E = FLOAT(NREP)                                                    310
      G = T1(KDTH)                                                       315
      F = G-T1(KSAV)                                                     320
C                                                                        325
C                                                                        330
      DO 60 I=II,III                                                     335
   60 T1(I) = (FLOAT(I-KSAV)/E)*F+T1(KSAV)                               340
C                                                                        345
C                                                                        350
   70 KSAV = KDTH                                                        355
   80 CONTINUE                                                           360
CC                                                                       365
C                                                                        370
      KDTH2 = Y(NE)+1.50+XINC                                            375
C      INSERT THE FIRST POINT, WHICH OTHERWISE WOULD BE THE LAST         380
C      ONE FOR WHICH Y(J).LT.1.                                          385
      T1(KDTH1) = X(JJJ)                                                 390
      T1(KDTH2) = X(NE)                                                  395
C      SAVE INDEX OF END OF ARRAY.                                       400
CCC                                                                      405
C                                                                        410
C      WRITE DOWN NUMBER AND LOCATIONS OF INTERPOLATED VALUES.           415
      WRITE (6,90) KCT,(KINS(I),I=1,KCT),(KNO(I),I=1,KCT)               420
   90 FORMAT (/5X,'BLANK ARRAY POSITIONS FILLED IN ',I3,' PLACES.  BEGIN 425
     1NING INDEXES AND NO. OF STEPS'/5X,'(10 EACH) ARE: ',5X,10I6/       430
     2 5X,10I6/)                                                         435
      RETURN                                                             440
      END                                                                445
```

```
C        ------------------------ SUBROUTINE TPRD ----------------------
CCC      TPRD IS A MODIFIED VERSION OF TAPRD, WHICH ALLOWS THE USER TO
CCC      READ MAGNETIC TAPE RECORDS WHICH CANNOT BE READ BY STANDARD
CCC      METHODS. TPRD DIFFERS FROM TAPRD ONLY IN THAT IT ALLOWS
CCC      RECORDS TO BE SKIPPED. THIS IS ACCOMPLISHED BY ALTERING THE
CCC      FOLLOWING CARDS:
CCC
CCC          CARD NO.        TAPRD VERSION              TPRD VERSION
CCC
CCC          TPR01430        TAPRD   CSECT              TPRD   CSECT
CCC          TPR01910        MVI   TPCCW,X'3F'        MVI   TPCCW,X'37'
CCC          TPR02990        TAPRD   CSECT              TPRD   CSECT
CCC
CCC      OTHERWISE, THE PROGRAMS ARE IDENTICAL. A LISTING OF TPRD VERSION
CCC      MINUS THE DOCUMENTATION IS PROVIDED BELOW.  SEE W.R.CHURCH
CCC      COMPUTER CENTER LIBRARY FOR LISTING OF TAPRD AND APPLICABLE
CCC      DOCUMENTATION.
C*       ..................................................................  TPR01300
*                                                                            TPR01310
         MACRO                                                               TPR01320
         REGS                                                                TPR01330
         LCLA  &N                                                            TPR01340
         LCLC  &SYM                                                          TPR01350
.LOOP    ANOP                                                                TPR01360
&SYM     SETC  'R&N'                                                         TPR01370
R&SYM    EQU   &SYM                                                          TPR01380
&N       SETA  &N+1                                                          TPR01390
         AIF   (&N LT 16).LOOP                                               TPR01400
         MEND                                                                TPR01410
         SPACE 2                                                             TPR01420
TPRD     CSECT                                                               TPR01430
         SPACE 2                                                             TPR01440
         REGS                                                                TPR01450
         SPACE 2                                                             TPR01460
         STM   R14,R12,12(R13)                                               TPR01470
         LR    R12,R15                                                       TPR01480
         USING TPRD,R12                                                      TPR01490
         LA    R11,SAVI        LINK  SAVE REGISTERS                          TPR01500
         ST    R13,4(R11)                                                    TPR01510
         ST    R11,8(R13)                                                    TPR01520
         LR    R13,R11                                                       TPR01530
         LR    R11,R1           GET ADDRESS OF ARGUMENT LIST                 TPR01540
         USING ARGS,R11                                                      TPR01550
         L     R10,AADD                                                      TPR01560
         ST    R10,SHOVAAD      PUT IN LIST FOR SHOVE CALL                   TPR01570
         L     R10,ALADD                                                     TPR01580
         L     R10,0(R10)       PUT LENGTH IN SAME LIST                      TPR01590
         ST    R10,SHOVALN                                                   TPR01600
```

```
         LA    R10,TPDCB                                                  TPR01610
         USING IHADCB,R10                                                 TPR01620
         TM    DCBOFLGS,X'10' HAS DCB BEEN OPENED?                        TPR01630
         BO    OOKK       YES                                             TPR01640
         TM    BADBOMB,X'AA'  HAS THERE BEEN PREVIOUS CATASTROPHE?        TPR01650
         BNO   ONWITHIT       NOPE, GO AND OPEN IT                       TPR01660
         SPACE 2                                                          TPR01670
KIKIT    ABEND 3,DUMP         SHOULDNT EVER GET HERE, CRASH              TPR01680
         SPACE 2                                                          TPR01690
ONWITHIT OPEN  (TPDCB,INPUT)                                             TPR01700
         TM    DCBOFLGS,X'10' DID STUPID THING OBEY?                      TPR01710
         BNO   KIKIT           NOPE, GO PUNT                            TPR01720
         L     R9,DCBDEBAD    GET POINTER AND DEVICE STATISTICS TABLE    TPR01730
         L     R9,32(R9)       GET UCB ADDR OUT OF DEB                  TPR01740
         SR    R6,R6                                                     TPR01750
         IC    R6,9(R9)       GET STAT TABLE POINTER                     TPR01760
         MH    R6,=H'10'      POINTER * 10                               TPR01770
         L     R9,16          POINTER TO CVT                             TPR01780
         L     R9,112(R9)     POINTER TO STAT TABLE START                TPR01790
         LA    R9,0(R6,R9)     GOTCHA STAT TABLE                         TPR01800
         ST    R9,STATTAB     SAVE ADDRESS OF STAT TABLE                 TPR01810
         MVC   OLDSTAT,0(R9)   SAVE ITS INFO                             TPR01820
         SPACE 2                                                          TPR01830
OOKK     L     R0,SHOVALN  GET BLKSIZE FOR TAPE EXCP BUFFER               TPR01840
         STH   R0,BYTCNT      PUT DATA LENGTH INTO CCW                   TPR01850
         L     R1,SHOVAAD                                                 TPR01860
         ST    R1,TPBUFLOC                                                TPR01870
         MVC   TPBLOC,TPBUFLOC+1  PUT BUFFER LOC IN CCW                   TPR01880
         LTR   R0,R0                                                      TPR01890
         BP    OOKKK                                                      TPR01900
         MVI   TPCCW,X'37'                                                TPR01910
         BAL   R9,TPGET                                                   TPR01920
         MVI   TPCCW,X'02'                                                TPR01930
         BAL   R9,TPWAIT                                                  TPR01940
         B     RETURN                                                     TPR01950
         SPACE 2                                                          TPR01960
         SPACE 2                                                          TPR01970
OOKKK    BAL   R9,TPGET       GO READ A BUFFER                           TPR01980
         SPACE 2                                                          TPR01990
         BAL  R9,TPWAIT       GO WAIT TILL READ FINISHED                 TPR02000
RETURN   LA    R15,0          NORMAL RETURN, MODIFIED ELSEWHERE          TPR02010
         L     R13,4(R13)     RESTORE REGISTERS                          TPR02020
         L     R14,12(R13)                                               TPR02030
         LM    R0,R12,20(R13)                                            TPR02040
         BR    R14            ALL RETURNS THRU HERE                      TPR02050
         SPACE 2                                                          TPR02060
TPEOF    MVI   RETURN+3,X'04'  SET EOF RETURN                            TPR02070
         SPACE 2                                                          TPR02080
```

```
OUT       CLOSE TPDCB                                                    TPR02090
          SPACE 2                                                        TPR02100
          MVI   BADBOMB,X'AA'  TURN ON FLAG                              TPR02110
          B     RETURN                                                   TPR02120
          SPACE 2                                                        TPR02130
GETSTAT   L     R9,STATTAB     ARRIVE HERE ON BAD READ                   TPR02140
          MVC   NEWSTAT,0(R9)   GET CURRENT STAT TABLE                   TPR02150
          L     R9,SHOVAAD     MOVE OLD AND NEW STAT TABLES TO FTN       TPR02160
          MVC   0(16,R9),OLDSTAT   ARRAY BEFORE ERROR RETURN             TPR02170
          MVI   RETURN+3,X'08'  SET I/O ERROR RETURN                     TPR02180
          B     OUT                                                      TPR02190
          SPACE 2                                                        TPR02200
TPGET     MVI   TPECB,X'00'    CLEAR ECB                                 TPR02210
          MVC   TPEXCP,TPCCW                                             TPR02220
          MVI   RDFLG,X'FF'    TURN ON READ FLAG                         TPR02230
          EXCP  TPIOB          DO IT                                     TPR02240
          BR    R9             RETURN                                    TPR02250
          SPACE 2                                                        TPR02260
TPWAIT    TM    TPECB,X'40'    IS IT ALREADY DONE?                       TPR02270
          BO    NOWAIT         YES                                       TPR02280
          WAIT  ECB=TPECB      NO,WAIT FOR IT                            TPR02290
NOWAIT    CLI   TPECB,X'7F'    DID IT DO IT OK?                          TPR02300
          BE    OK1            YES,CONTINUE                              TPR02310
          SPACE 2                                                        TPR02320
          CLI   TPCSW+3,X'0D' PROBABLE EOF IF CHAN-DEV END & UNIT EXCPT  TPR02330
          BNE   GETSTAT       NOPE, GO FIND ERROR                        TPR02340
          CLI   FLAGS1,X'04'   EXCEPTIONAL CONDIT BIT ON? (=EOF)         TPR02350
          BNE   GETSTAT       NO EOF                                     TPR02360
          L     R1,DCBBLKCT    DECREMENT  DCBBLKCT SO IT MATCHES TAPE    TPR02370
          BCTR  R1,0               TRAILER LABELS                        TPR02380
          ST    R1,DCBBLKCT                                              TPR02390
          EOV   TPDCB          YES,EOF - FORCE CONTROL TO EODAD RTN      TPR02400
          SPACE 2                                                        TPR02410
OK1       BR    R9               RETURN                                  TPR02420
          SPACE 2                                                        TPR02430
SAV1      DC    18F'0'                                                   TPR02440
          SPACE 2                                                        TPR02450
OLDSTAT   DC    D'0'             COPY OF STAT TABLE AFTER OPEN           TPR02460
NEWSTAT   DC    D'0'             COPY OF STAT TABLE UPON ERROR           TPR02470
          SPACE 2                                                        TPR02480
TPEXCP    DC    D'0'            LOC CONTAINING CCW BEING USED            TPR02490
TPCCW     DC    X'02'            READ                                    TPR02500
TPBLOC    DC    AL3(0)           DATA ADDRESS                            TPR02510
FLGS      DC    X'20'            SUPPRESS INCORRECT LNGT                 TPR02520
BYTCNT    DC    H'0'             BYTE COUNT                              TPR02530
          SPACE 2                                                        TPR02540
SHOVSMF   DC    A(0)             LOC OF SMF INFO                         TPR02550
SHOVAAD   DC    A(0)             ADDR OF FORTRAN ARRAY                   TPR02560
```

```
SHOVALN  DC     F'0'            BYTE LENGTH OF FORTRAN ARRAY                TPR02570
         SPACE 2                                                             TPR02580
TPBUFLOC DC     A(0)            LOC OF DCBBLKSI LENGTH TAPE BUFFER          TPR02590
         SPACE 2                                                            TPR02600
STATTAB  DC     A(0)            LOC OF STAT TABLE                           TPR02610
         SPACE 2                                                            TPR02620
         SPACE 2                                                            TPR02630
RDFLG    DC     X'00'            =X'FF' AFTER READ, BEFORE WAIT             TPR02640
BADBOMB  DC     X'00'           FLAG TO TELL WHETHER DCB USED BEFORE        TPR02650
         SPACE 2                                                            TPR02660
TPDCB    DCB    DDNAME=METTAP,MACRF=(E),EODAD=TPEOF,DSORG=PS,              *TPR02670
                IOBAD=TPIOB,DEVD=TA                                         TPR02680
         SPACE 2                                                            TPR02690
         DS     0F                                                          TPR02700
TPIOB    DS     0CL32                                                       TPR02710
FLAGS1   DC     X'00'                                                       TPR02720
FALGS2   DC     X'00'                                                       TPR02730
SENSE1   DC     X'00'                                                       TPR02740
SENS2    DC     X'00'                                                       TPR02750
ECBCOD   DC     X'00'                                                       TPR02760
ECBADD   DC     AL3(TPECB)                                                  TPR02770
FALGS3   DC     X'00'                                                       TPR02780
TPCSW    DC     7X'00'                                                      TPR02790
SIOCODE  DC     X'00'                                                       TPR02800
EXCPADD  DC     AL3(TPEXCP)                                                 TPR02810
RESERC   DC     X'00'                                                       TPR02820
DCBADDR  DC     AL3(TPDCB)                                                  TPR02830
REPOMOD  DC     X'00'                                                       TPR02840
RESTADR  DC     AL3(0)                                                      TPR02850
BLCINC   DC     H'1'                                                        TPR02860
ERORCNT  DC     H'0'                                                        TPR02870
         SPACE 2                                                            TPR02880
TPECB    DC     F'0'                                                        TPR02890
         SPACE 2                                                            TPR02900
ARGS     DSECT                                                             TPR02910
AADD     DC     A(0)            ADDRESS OF FORTRAN ARRAY                    TPR02920
ALADD    DC     A(0)            ADDRESS OF LENGTH OF FORTRAN ARRAY          TPR02930
         SPACE 2                                                            TPR02940
         PRINT NOGEN                                                        TPR02950
         DCBD  DSORG=PS,DEVD=TA                                             TPR02960
         PRINT GEN                                                          TPR02970
         SPACE 2                                                            TPR02980
TPRD     CSECT                                                             TPR02990
         LTORG                                                              TPR03000
         END                                                                TPR03010
```

APPENDIX B

```
C TITLE          DIGIXBT                                                    5
C                                                                          10
C                                                                          15
C PROGRAMERS     R.E.BLUMBERG, R.E. GREER. ADAPTED FROM DIGISTD PROGRAM     20
C                 WHICH WAS AN EXTENSIVE MODIFICATION OF AN ORIGINAL       25
C                 PROGRAM, MIZ2, BY R.G. PAQUETTE.                         30
C                                                                          35
C DOCUMENTATION  R.E.BLUMBERG                                              40
C                                                                          45
C DATE           26 JUNE 1975                                              50
C                                                                          55
C PURPOSE        PROGRAM READS AND PROCESSES DIGITIZED TEMPERATURE,AND     60
C                 DEPTH DATA FROM A CALMA DIGITIZER 7-TRACK TAPE.THE       65
C                 DATA IS COMPUTED AND STORED FOR EVERY 0.01 OF AN INCH    70
C                 OF DEPTH INCREMENT ON THE XBT TRACE. PROGRAM COMPUTES    75
C                 DEPTH AND TEMPERATURE FOR EACH INDIVIDUAL                80
C                 OCEANOGRAPHIC STATION AND PERMITS PRINTED, PUNCHED       85
C                 CARD OR 9-TRACK TAPE OUTPUT. NOTE, THIS PROGRAM IS       90
C                 SET UP TO PROCESS WATER TEMPS BETWEEN 1 AND 25 DEGREES   95
C                 CELSIUS.                                                100
C                                                                         105
C SEQUENCE       THE PROGRAM PERFORMS THESE FUNCTIONS IN THE FOLLOWING     110
C                 SEQUENCE:                                               115
C                   (A) INITIALIZES ALL ARRAYS AND VARIABLES              120
C                   (B) SKIPS XXX NUMBER OF RECORDS IF NSKP=GREATER THAN  125
C                     ZERO.                                               130
C                   (C) READ PAIR OF DATA CARDS (LABEL AND DAT) FOR       135
C                     RECORD BEING PROCESSED. COUNT RECORDS.              140
C                   (D) PROGRAM TERMINATES IF ISTOP=1 OR DESIRED NUMBER   145
C                     OF RECORDS PROCESSED.                               150
C                   (E) HEADER INFO MISSING ON TAPE, INSERT ON CARDS BY   155
C                     SETTING IHDR=1.                                     160
C                   (F) SKIP UNREADABLE OR BAD RECORD IF NRCSKP SET       165
C                     EQUAL TO THE BAD RECORD NUMBER.                     170
C                   (G) READ USABLE RECORD INTO THE A ARRAY               175
C                   (H) MOVE BYTES OF A ARRAY INTO 4-BYTE WORDS OF B      180
C                     ARRAY TO ALLOW PROCESSING BY STANDARD FORTRAN.      185
C                   (I) PROCESS RAW B ARRAY                               190
C                       (1) IF HEADER RECORD, PROGRAM DECODES HEADER      195
C                         LABEL AND COMPARES TO LABEL SUPPLIED BY DATA     200
C                         CARD.                                           205
C                       (2) IF TRACER RECORD, PROGRAM ADDS AND STORES     210
C                         CUMULATIVE SUMS OF X AND Y DISTANCE TRAVEL.     215
C                         SUBROUTINE CONDNS INDEXES THE VALUES OF         220
```

```
C                    CUMULATIVE DISTANCE BY INCREASING DEPTH UNITS.
C                  (J) CONVERT THE X AND Y ARRAYS TO DEPTH AND
C                    TEMPERATURE.
C                  (K) MANUALLY INSERT SURFACE AND NEAR SURFACE VALUES
C                    VIA DATA CARDS.
C                  (L) ELIMINATE EXCESSIVELY HIGH OR LOW VALUES.
C                  (M) COMPUTE CONSECUTIVE RECORD SERIALIZATION FOR
C                    TAPE OUTPUT NUMBERING SCHEME.
C                  (N) CONVERTS LETTER DESIGNATOR MONTH/YEAR CODE,
C                    AMONC, TO REAL*8 MONTH AND YEAR.
C                  (O) DATA OUTPUT IN EITHER REGULAR PRINTOUT, TAPE, OR
C                    PUNCHED CARDS. CARD OUTPUT SUITABLE FOR THESIS1.
C                  (P) INITIALIZE ARRAYS AND VARIABLES FOR PROCESSING
C                    NEXT STATION'S DATA.
C                  (Q) REPEAT STEPS (C) THRU (P) UNTIL ALL RECORDS ARE
C                    PROCESSED, ISTOP=1, OR THE NUMBER OF DESIRED
C                    RECORDS (NN) ARE READ.
C
C FEATURES       THIS IS A HIGHLY VERSATILE PROGRAM FOR PROCESSING
C                  OCEANOGRAPHIC DATA FROM 7-TRACK TAPE. FEATURES OF THE
C                  PROGRAM ARE LISTED UNDER THE FOLLOWING SIX GENERAL
C                  CATEGORIES:
C                   (A) INPUT
C                      (1) 7-TRACK CALMA DIGITIZER TAPE IN BCD.
C                      (2) TWO DATA CARDS REQUIRED PER TRACE SEGMENT
C                        RECORD OR HEADER LABEL RECORD. AN XBT TRACE
C                        REQUIRES 4 CARDS, ONE PAIR FOR THE HEADER AND
C                        ONE PAIR FOR THE TRACE. THE FOLLOWING IS A
C                        SAMPLE DATA DECK SHOWING DATA CARDS FOR STATION
C                        207 AND 208. ALSO SHOWN IS THE 'STATION END'
C                        CARD WITH ISTOP SET EQUAL TO ONE. THIS IS
C                        FOLLOWED BY THE JCL NECESSARY TO READ THE 7-
C                        TRACK TAPE.COLUMN 1 IS BLANK ON THE DATA CARDS.
C      &CONTRL NN=104,IDSCL=1,ICODE=0,ITSCL=1,ISCL=1,IP=1,ISQZ=01,
C      ICSQZ=3,TAPE=F,CARDS=F,TCOR=-.13,XBTCOR=0.0,NSKP=6,&END
C          UCMXBT STATIONS 201V THRU 317V TAPE UCM011
C          HEADER XBT
C      &DAT  IDEPTH=99,ISTA=207,AMONC='V',&END
C          TRACER XBT                                                V
C      &DAT   IDEPTH=00,DH=0.0,TH=12.12,IH=1,&END
C          HEADER XBT
C      &DAT  IDEPTH=99,ISTA=208,AMONC='V',&END
C          TRACER XBT                                                V
C      &DAT   IDEPTH=00,&END
C           STATION END                                             1
C     //GO.METTAP DD UNIT=2400-1,VOL=SER=UCM011,DISP=OLD,LABEL=(,NL),
C     //       DCB=(DEN=1,TRTCH=ET)
C                  (B) SUBROUTINES
```

```
C                  (1) TPRD-READS THE 7-TRACK MAGNETIC TAPE.                    465
C                  (2) CHMOVE- TAKES THE DATA THAT HAS BEEN READ                470
C                    INTO THE A ARRAY AND STORES IT IN USABLE FORM              475
C                    IN THE B ARRAY.                                            480
C                  (3) CONDNS- INDEXES THE VALUES OF CUMULATIVE                 485
C                    DISTANCE BY INCREASING DEPTH UNITS.                        490
C                  (4) OUT2- PRINTS OUT OCEANOGRAPHIC STATION DATA.             495
C               (C) AUTOMATIC DATA PROCESSING/HANDLING                          500
C                  (1) HANDLES OPERATOR MISTAKES MADE IN TRACING XBT            505
C                    CURVES ON CALMA DIGITIZER.                                 510
C                  (2) SKIPS INITIAL NUMBER AND INDIVIDUAL BAD                  515
C                    RECORDS ON 7-TRACK TAPE.                                   520
C                  (3) DECODES 7-TRACK TAPE HEADER LABELS AND TRACE             525
C                    RECORDS.                                                   530
C                  (4) COMPUTES DATA FOR EVERY 0.01 INCH OF CALMA               535
C                    DIGITIZER STYLUS MOVEMENT.                                 540
C                  (5) ALLOWS ENTRY OF HAND ENTERED DATA FOR                    545
C                    SURFACE AND NEAR SURFACE VALUES.                           550
C                  (6) EDITS OUT EXCESSIVELY LOW & HIGH VALUES.                 555
C                  (7) PROVIDES CONSECUTIVE RECORD SERIALIZATION                560
C                    FOR TAPE OUTPUT.                                           565
C               (D) DIAGNOSTICS                                                 570
C                  (1) WRITES FIRST TWENTY FIVE VALUES OF DEPTH AND             575
C                    TEMPERATURE FOR DATA INSPECTION.                           580
C               (E) TROUBLE-SHOOTING                                            585
C                  (1) HANDLES MULTIPLE KEYBOARD AND TRACER SYMBOL              590
C                    ENTRIES.                                                   595
C                  (2) PROVIDES FOR A MISSED OR INCOMPLETE HEADER               600
C                    LABEL.                                                     605
C                  (3) HANDLES MISSING INTER-RECORD GAP (IRG).                  610
C                  (4) HANDLES DELETE RECORD BY INCREMENTING RECORD             615
C                    COUNT AND READING SAME PAIR OF CARDS AGAIN.                620
C                  (5) COMPARES CARD HEADER LABEL AND TAPE HEADER               625
C                    LABEL AND ACCEPTS CARD VALUES IF CARD AND TAPE             630
C                    DISAGREE.                                                  635
C               (F) OUTPUT                                                      640
C                  (1) PRINTER- TWO PRINTING VARIABLES, PRT1 AND                645
C                    PRT2. PRT2 PROVISION ONLY.                                 650
C                  (2) CARD-PUNCHED DATA CARDS SUITABLE FOR USE WITH            655
C                    THESIS1.                                                   660
C                  (3) TAPE- 9-TRACK TAPE                                       665
C                  (4) PLOTTING- PROVISION FOR PLOTTING ROUTINES                670
C                    ACTUATED BY PLT1 AND PLT2 ARE NOT PRESENTLY                675
C                    PROGRAMMED.                                                680
C                                                                               685
C ARGUMENTS      PROGRAM CONSISTS OF MANY TERMS,ARRAYS,AND VARIABLES.           690
C                  SOME OF THESE VARIABLES ARE USED IN THE DIGISTD              695
C                  PROGRAM. THEY WERE INCLUDED IN THIS PROGRAM TO KEEP          700
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C     THE HEADER LABEL PROCESSING ON THE CALMA DIGITIZER                705
C     THE SAME FOR BOTH STD AND XBT TRACES. THESE VARIABLES             710
C     ARE IDENTIFIED BELOW AND ARE SET EQUAL TO A CONSTANT              715
C     IN THIS PROGRAM.                                                  720
C     THE FOLLOWING IS A BRIEF DESCRIPTION OF THE                       725
C     IMPORTANT ARGUMENTS LISTED ALPHABETICALLY UNDER TWO               730
C     GENERAL CATEGORIES:                                               735
C                                                                       740
C      (A) ARRAYS                                                       745
C          D,T      = DEPTH,TEMPERATURE                                 750
C          DH,TH    = HAND-ENTERED SURFACE OR NEAR SURFACE              755
C                     DATA                                              760
C          X,Y      = CUMULATIVE SUMS OF DISTANCE TRAVELED BY           765
C                     THE DIGITIZER STYLUS. STORAGE IS                  770
C                     PROVIDED FOR 20 INCHES TOTAL TRAVEL               775
C                     OF THE STYLUS ON EACH COORDINATE                  780
C                     AXIS. THIS INCLUDES BOTH PLUS AND MINUS           785
C                     DIRECTIONS.                                       790
C          NRCSKP   = NUMBER OF THE INDIVIDUAL RECORD SKIPPED           795
C          DCON     = DEPTH CONSTANT  NUMBER OF 0.01 INCHES             800
C                     PER UNIT OF DEPTH.                                805
C          IREC     = CONSECUTIVE SERIAL RECORD NUMBER FOR              810
C                     TAPE                                              815
C          AMONCA   = MONTH/YEAR CODE LETTER.                           820
C          EVENT    = MONTH AND YEAR.                                   825
C                                                                       830
C      (B) VARIABLES                                                    835
C          CARDS    = PERMITS PUNCHING CARDS                            840
C          CONTRL   = NAMELIST VARIABLE USED FOR INFREQUENTLY           845
C                     CHANGED VARIABLES.                                850
C          DCOR     = DEPTH CORRECTION TERM.                            855
C          DAT      = NAMELIST VARIABLE USED FOR                        860
C                     FREQUENTLY CHANGED VARIABLES.                     865
C          DLTREC   = DELETE RECORD                                     870
C          FLAG     = INDICATES START OF DATA TRACE.                    875
C          ICODE    = VARIABLE HELD OVER FROM DIGISTD                   880
C                     ICODE IS A CONSTANT = ZERO.                       885
C          ICSQZ    = VARIABLE USED TO COMPRESS NUMBER OF               890
C                     DATA POINTS PUNCHED ON CARDS.                     895
C          IDENT    = VARIABLE USED TO IDENTIFY HEADER                  900
C                     LABEL, (IDENT =99) OR TRACE RECORD                905
C                     (IDENT = 00).                                     910
C          IDSCL    = VARIABLE HELDOVER FROM DIGISTD PROGRAM            915
C                     IDSCL IS A CONSTANT = 1.                          920
C          IH       = NUMBER OF HAND ENTERED SURFACE OR                 925
C                     NEAR-SURFACE DATA VALUES.                         930
C          IHDR     = VARIABLE USED TO IDENTIFY MISSED HEADER           935
C                     LABEL ON TAPE. ALLOWS MISSING INFO TO BE          940
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C                    INSERTED ON CARDS.                                    945
C          IP      = VARIABLE IDENTIFIES LAST RECORD OF                    950
C                    PARTICULAR STATION. SINCE XBT IS A                    955
C                    SINGLE TRACE IP IS A CONSTANT = 1.                    960
C          ISCL    = VARIABLE HELD OVER FROM DIGISTD                       965
C                    PROGRAM ISCL IS A CONSTANT = 1.                       970
C          ISQZ    = VARIABLE USED TO COMPRESS NUMBER                      975
C                    OF DATA POINTS PRINTED BY PRINTER.                    980
C          ISTA    = VARIABLE IDENTIFIES STATION NUMBER.                   985
C          ISTOP   = VARIABLE TERMINATES PROGRAM IF = 1 ON                 990
C                    FINAL &DAT CARD.                                      995
C          ITSCL   = VARIABLE HELDOVER FROM DIGISTD PROGRAM               1000
C                    ITSCL IS A CONSTANT = 1.                             1005
C          JREC    = VARIABLE USED TO COUNT RECORDS FOR                   1010
C                    RECORD SERIALIZATION PURPOSES.                       1015
C          JSKIP   = VARIABLE USED TO CONTRL NUMBER OF                    1020
C                    DATA CARDS READ.                                     1025
C          KEY     = KEYBOARD SYMBOL ON THE DIGITIZED TAPE.               1030
C          KDTH2   = NUMBER OF RECORD PROCESSED FOR                       1035
C                    PARTICULAR STATION.                                  1040
C          LABEL   = HEADER TYPE DATA CARD WHICH                          1045
C                    IDENTIFIES STATION NUMBER, MONTH, ETC.               1050
C          NCRDS   = NUMBER OF CARDS PUNCHED BY CARDS                     1055
C                    PUNCHING ROUTINE.                                    1060
C          NE      = AN INDEX AT THE LAST USEFUL ARRAY                    1065
C                    POSITION OF THE X(DEPTH) ARRAY.                      1070
C          NOIRG   = VARIABLE USED TO INDICATE MISSING                    1075
C                    END OF RECORD GAP ON TAPE.                           1080
C          NPTS    = NUMBER OF DATA POINTS TO BE PUNCHED                  1085
C                    BY CARDS PUNCHING ROUTINE.                           1090
C          NSKP    = NUMBER OF INITIAL RECORDS ON TAPE                    1095
C                    TO BE SKIPPED                                        1100
C          TCOR    = CORRECTION FACTOR ADDED TO                           1105
C                    TEMPERATURE DATA VALUES.                             1110
C          WMONTH  = REAL*8 -MONTH AND YEAR                               1115
C     ---------------------- SUBROUTINE TPRD ----------------------
C     TPRD IS IN ASSEMBLER LANGUAGE AND REQUIRES SPECIAL JCL.
C     THE COMMENT CARDS ARE INCLUDED HERE BECAUSE NO COMMENT CARDS ARE
C     ALLOWED TO BE MIXED WITH THE ASSEMBLER LANGUAGE SUBROUTINE.
C     A  /*  FOLLOWED BY A  //ASM.SYSIN DD *  MUST PRECEDE THE DECK.
C     THIS DECK IS RUN UNDER // EXEC FORTCALG.
C     TPRD IS A MODIFIED VERSION OF TAPRD, WHICH ALLOWS THE USER TO
C     READ MAGNETIC TAPE RECORDS WHICH CANNOT BE READ BY STANDARD
C     METHODS. TPRD DIFFERS FROM TAPRD ONLY IN THAT IT ALLOWS
C     RECORDS TO BE SKIPPED. THIS IS ACCOMPLISHED BY ALTERING THE
C     FOLLOWING CARDS:
C
C         CARD NO.        TAPRD VERSION              TPRD VERSION
```

```
C
C          TPRO1430        TAPRD   CSECT                   TPRD   CSECT
C          TPRO1910        MVI   TPCCW,X'3F'               MVI   TPCCW,X'37'
C          TPRO2990        TAPRD   CSECT                   TPRD   CSECT
C
C        OTHERWISE, THE PROGRAMS ARE IDENTICAL. A LISTING OF TPRD VERSION
C        MINUS THE DOCUMENTATION IS PROVIDED BELOW.  SEE W.R.CHURCH
C        COMPUTER CENTER LIBRARY FOR LISTING OF TAPRD AND APPLICABLE
C        DOCUMENTATION.
C                                                                        1120
      DIMENSION X(4001), Y(4001), LABEL(19), TH(12), DH(12), IREC(1801),  1125
     1 NRCSKP(99), DCON(1), AMONCA(13), EVENT(13), D(1801), T(1801)      1130
      INTEGER B(8001),ZER,DOL,STAR,ONE,FLAG,DLTREC,DLR,BLANK,A(2001),TWO  1135
     1,THREE,FOUR,FIVE,SIX,SEVEN,EIGHT,TEN,ELEVEN,AMONT                  1140
      LOGICAL PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,SKIP                  1145
C       ***************************************************************  1150
C                                                                        1155
      NAMELIST /CONTRL/ NN,PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,ISTOP,IP  1160
     1,IH,NRCSKP,NSKP,JSKIP,ISQZ,IDSCL,ICODE,ITSCL,ISCL,XBTCOR,ICSQZ,TCO  1165
     2R/DAT/TH,DH,IH,ICODE,ISCL,ITSCL,IDSCL,IP,IDEN,ISQZ,ITSQZ,ICSQZ,TCO  1170
     3R,IHDR,NOIRG,CARDS,ISTA,DCON,DCOR,SKIP,AMONC,TAPE                   1175
C                                                                        1180
C       ***************************************************************  1185
C                                                                        1190
      REAL *8EVENT,WMONTH                                                1195
      DATA AMONCA/'H','I','C','K','L','O','P','Q','R','U','V','W','Z'/   1200
      DATA EVENT/'AUG 1973','SEP 1973','OCT 1973','NOV 1973','DEC 1973',  1205
     1'JAN 1974','FEB 1974','MAR 1974','APR 1974','MAY 1974','JUN 1974',  1210
     2'JUL 1974','AUG 1974'/                                             1215
C                                                                        1220
C       DEFINE SYMBOLS, NOTEING THAT THE LEFT THREE HEX BYTES IN EACH    1225
C       ELEMENT OF B END UP FILLED WITH BLANKS                           1230
      DATA DOL/'$$$$'/,STAR/Z4040405C/,KEY/Z4040405F/,ONE/Z404040F1/,     1235
     1FLAG/Z40404050/,DLTREC/Z40404060/,MINUS/Z40404061/,                1240
     2 DLR/Z4040405B/,BLANK/'    '/,ZER/Z404040F0/,TWO/Z404040F2/,        1245
     3THREE/Z404040F3/,FOUR/Z404040F4/,FIVE/Z404040F5/,                  1250
     4MTWO/Z404040E2/,MTHREE/Z404040E3/,MFOUR/Z404040E4/,MFIVE/Z404040E5 1255
     5/,SIX/Z404040F6/,SEVEN/Z404040F7/,EIGHT/Z404040F8/,NINE/Z404040F9  1260
     6/,TEN/Z404040F0/,ELEVEN/Z4040407B/                                 1265
C                                                                        1270
C       ***************************************************************  1275
C***(A) INITIALIZE VARIABLES AND ARRAYS.*********************************  1280
C                                                                        1285
C       THE FOLLOWING CONVERSION FACTOR IS IN HUNDREDS OF INCHES PER     1290
C        UNIT OF T. IT MAY BE OVERRIDDEN BY THE DATA CARDS.              1295
      DCON(1) = 1.0475                                                   1300
C                                                                        1305
      DATA CARDS/.FALSE./,DCOR/0.0/,ENDFL/.FALSE./,FG/0./,ICODE/0/,ICSQZ  1310
```

```
     1/1/,IDSCL/1/,IH/0/,IHDR/0/,IP/0/,IPS/8000/,ISCL/1/,ISQZ/1/,ISTOP/0     1315
     2/,ITSCL/1/,ITSQZ/1/,JJJ/0/,JJJJ/0/,JREC/1/,JSAV/0/,KDTH1/1/,KDTH2/     1320
     31/,NE/0/,NOIRG/0/,NSKP/0/,PLT1/.FALSE./,PLT2/.FALSE./,PRT1/.TRUE./     1325
     4,PRT2/.FALSE./,SKIP/.FALSE./,TAPE/.FALSE./,TCOR/0./                    1330
C                                                                             1335
CCC     GIVE THE ARRAYS INITIAL VALUES                                        1340
CCCC                                                                          1345
CCC                                                                           1350
C                                                                             1355
      DO 20 J=1,12                                                            1360
      TH(J) = 0.                                                              1365
      DH(J) = 0.                                                              1370
   20 CONTINUE                                                                1375
C                                                                             1380
CCCC                                                                          1385
CCC                                                                           1390
C                                                                             1395
      DO 30 J=1,1801                                                          1400
      D(J) = 0.                                                               1405
      T(J) = 0.                                                               1410
   30 CONTINUE                                                                1415
C                                                                             1420
CCCC                                                                          1425
CCC                                                                           1430
C                                                                             1435
      DO 40 J=1,99                                                            1440
      NRCSKP(J) = 0                                                           1445
   40 CONTINUE                                                                1450
C                                                                             1455
CCC                                                                           1460
C                                                                             1465
      READ (5,CONTRL)                                                         1470
      READ (5,140) LABEL                                                      1475
      WRITE (6,150) LABEL                                                     1480
C      REWIND HERE IF TAPE IS USED. NOTE THAT IF TAPE=T,JCL                   1485
C      MUST BE PROVIDED TO DEFINE IT.                                         1490
      IF (TAPE) REWIND 8                                                      1495
      IF (NSKP.EQ.0) GO TO 110                                                1500
C                                                                             1505
CC     ********************************************************************   1510
C***(B) SKIP RECORDS.*************************************************       1515
C                                                                             1520
C      NOTE: THE PROGRAM DIFFERENTIATES BETWEEN INITIALLY SKIPPED             1525
C      RECORDS (NSKP) AND BAD RECORDS (NRCSKP).  NRCSKP                       1530
C      REQUIRES DATA CARDS FOR BAD RECORDS SKIPPED AND NSKP                   1535
C      DOESN'T. PLUS NRCSKP ONLY SKIPS A SINGLE RECORD FOR EACH               1540
C      VALUE ASSIGNED TO NRCSKP, WHEREAS NSKP SKIPS MULTIPLE                  1545
C      RECORDS (IE. NSKP=40, THE FIRST 40 RECORDS ON THE TAPE                 1550
```

```
C       WILL BE SKIPPED.) NSKP                                                  1555
C       AS WELL AS THE 10 VALUES OF NRCSKP MUST BE ON THE FIRST                 1560
C       CONTRL CARD ONLY. A SINGLE CONTRL CARD IS READ HERE AT THE              1565
C       START TO SET NSKP AND NRCSKP.                                           1570
C                                                                               1575
C                                                                               1580
C                                                                               1585
C                                                                               1590
      DO 50 IS=1,NSKP                                                           1595
      IIS = IS                                                                  1600
C       IPS IS SET NEGATIVE DURING THE SKIP PROCESS. THIS AVOIDS TPRD           1605
C       STOPPING ON UNREADABLE RECORDS. IPS IS THE MAXIMUM NUMBER OF            1610
C       BYTES OF DATA WHICH WILL BE READ FROM ONE RECORD OF DIGITIZER           1615
C       TAPE BY TPRD. IPS/2 IS THE MAXIMUM TOTAL TRAVEL ALONG THE CURVE         1620
C       MEASURED IN HUNDREDTHS OF AN INCH IN THE X AND Y DIRECTIONS             1625
C       SEPARATELY. NO DATA CARDS ARE NEEDED FOR SKIPPED RECORDS.               1630
      IPS = -8000                                                               1635
   50 CALL TPRD (A,IPS,&70,&90)                                                 1640
C                                                                               1645
C                                                                               1650
C                                                                               1655
C       RESET IPS FOR NORMAL TAPE READING                                       1660
      IPS = 8000                                                                1665
      WRITE (6,60) IIS                                                          1670
   60 FORMAT (/5X,I5,' RECORDS SKIPPED'/)                                       1675
      GO TO 110                                                                 1680
C                                                                               1685
C       END AND ERROR MESSAGES.  PROGRAM STOPS                                  1690
   70 WRITE (6,80) IIS                                                          1695
   80 FORMAT (/5X,'FOUND END OF FILE ON RECORD',I4,'DURING SKIP PROCESS'        1700
     1 /)                                                                       1705
      GO TO 1370                                                                1710
   90 WRITE (6,100) IIS,A(1),A(2),A(3),A(4)                                     1715
  100 FORMAT (/5X,'READ ERROR ON RECORD',I5,'ERROR STATISTICS ARE: ',4Z8        1720
     1)                                                                         1725
      GO TO 1370                                                                1730
C                                                                               1735
C       REDEFINE LOOP INDEX TO START AT ONE.                                    1740
  110 NNN = NN-NSKP                                                             1745
C                                                                               1750
C       ***************************************************************       1755
C***(C) READ CARDS AND START MAIN LOOP. COUNT RECORDS.*****************         1760
C       ***************************************************************       1765
C***(D) TERMINATE PROGRAM IF ISTOP=1 OR NUMBER OF RECORDS PROCESSED.****        1770
C                                                                               1775
      IT = 1                                                                    1780
  120 IF (IT.GT.NNN) GO TO 1370                                                 1785
      IPS = 8000                                                                1790
```

```
      NREC = IT*NSKP                                                    1795
      WRITE (6,130) NREC                                                1800
  130 FORMAT (/5X,'LABEL 130 ; START MAIN LOOP.  RECORD NO. ',I3/)      1805
C       THE NUMBER OF RECORDS TREATED IS DETERMINED BY SETTING          1810
C       NN= NUMBER OF RECORDS ON THE CONTRL CARD. OR THE PROGRAM MAY    1815
C       BE STOPPED BY SETTING ISTOP.GT.0 ON THE LABEL CARD.             1820
C       THE LABEL CARD HAS THE LAST FOUR COLUMNS FOR CONTROL ALTHOUGH   1825
C       ONLY THREE ARE USED HERE. THE 77-TH COLUMN IS JSKIP; IF IT      1830
C       IS ZERO, ONLY TWO CARDS ARE READ. IF IT IS 1 AN ADDITIONAL CARD,1835
C       AN &CONTRL CARD, CAN ALSO BE READ. THE 78-TH COLUMN IS ISTOP;   1840
C       IF IT IS =1 THE PROGRAM STOPS. THE 79-TH COLUMN IS AMONC;       1845
C       IT IS AN ALPHABETIC CHARACTER THAT DESIGNATES THE MONTH         1850
C       IN WHICH THE DATA WERE TAKEN. NOTE THAT THIS NEEDS TO BE        1855
C       ON THE LAST CARD SET READ BEFORE PRINTING. AMONC MAY ALTERNATELY 1860
C       BE ADDED ON THE &DAT HEADER CARD.                               1865
      READ (5,140) LABEL,JSKIP,ISTOP,AMONC                              1870
  140 FORMAT (19A4,2I1,A1)                                              1875
      IF (ISTOP.GT.0) GO TO 1370                                        1880
      READ (5,DAT)                                                      1885
      WRITE (6,150) LABEL                                               1890
      WRITE (6,DAT)                                                     1895
C       NORMALLY TWO DATA CARDS ARE EXPECTED TO BE READ PER RECORD,     1900
C       LABEL AND DAT.  LESS FREQUENTLY CHANGED NUMBERS ARE ON CONTRL.  1905
      JJJJ = 0                                                          1910
      NOIRG = 0                                                         1915
      IF (JSKIP.EQ.0) GO TO 160                                         1920
      READ (5,CONTRL)                                                   1925
      WRITE (6,CONTRL)                                                  1930
  150 FORMAT (/5X,19A4/)                                                1935
C                                                                       1940
C       ***************************************************************1945
C***(E) HEADER INFO MISSING.*************************************************1950
C                                                                       1955
C       IHDR=1 ON &DAT PROVIDES FOR MISSED HEADER INSERT ALL THE        1960
C       HEADER INFO ON CARDS, BRANCH TO 540 AND THEN RETURN TO START AT 1965
C       120 WITHOUT INCREMENTING THE RECORD COUNT.                      1970
  160 IF (IHDR.EQ.1) GO TO 540                                          1975
  170 CONTINUE                                                          1980
C                                                                       1985
C       DIAGNOSTIC WRITE STATEMENTS FOLLOW:                             1990
C                                                                       1995
  180 FORMAT (5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2000
     12/5X,11F7.2/5X,11F7.2/5X,3F7.2,60X,I6)                            2005
  190 FORMAT (7X,' JJJ,  NE  ,KDTH1,KDTH2,JJJJ'/4X,5I6)                 2010
      IPLACE = 170                                                      2015
      WRITE (6,180) (D(J),J=1,1801,20),IPLACE                           2020
      WRITE (6,180) (T(J),J=1,1801,20),IPLACE                           2025
      WRITE (6,190) JJJ,NE,KDTH1,KDTH2,JJJJ                             2030
```

```
C-------------------                                                    2035
C                                                                       2040
C       FILL THE A ARRAY WITH DOLLARS                                   2045
C                                                                       2050
C                                                                       2055
C                                                                       2060
      DO 200 I=1,2001                                                   2065
C      THE 2001 ASSURES THAT THE LAST WORD OF A WILL CONTAIN DOLLARS     2070
C      SINCE WE READ IN ONLY 8000 BYTES OF DATA.                        2075
  200 A(I) = DOL                                                        2080
C                                                                       2085
C                                                                       2090
C                                                                       2095
C       FILL B WITH BLANKS                                              2100
C                                                                       2105
C                                                                       2110
C                                                                       2115
      DO 210 I=1,8000                                                   2120
  210 B(I) = BLANK                                                      2125
C                                                                       2130
C                                                                       2135
C                                                                       2140
C      ***************************************************************  2145
C***(F) SKIP BAD RECORDS.*************************************************  2150
C                                                                       2155
C       THE LIST OF BAD RECORDS IS EXAMINED AND SKIPPED.                2160
C       DO NOT REMOVE THE DATA CARDS FOR THE BAD RECORD.                2165
C       NOTE THAT IF NRCSKP(1) IS ZERO, THE TEST IS SKIPPED.            2170
      IF (NRCSKP(1).EQ.0) GO TO 250                                     2175
C                                                                       2180
C                                                                       2185
C                                                                       2190
      DO 220 J=1,99                                                     2195
      NRC = NRCSKP(J)-NSKP                                              2200
      IF (NRC.EQ.IT) GO TO 230                                          2205
  220 CONTINUE                                                          2210
C                                                                       2215
C                                                                       2220
C                                                                       2225
      GO TO 250                                                         2230
C      CHANGING IPS TO NEGATIVE CAUSES TPRD TO SKIP A RECORD            2235
  230 IPS = -8000                                                       2240
  240 FORMAT (//5X,'LABEL 240. RECORD NO.',I5,' SKIPPED VIA NRCSKP SKIP 2245
     1 ROUTINE.'//)                                                     2250
      WRITE (6,240) IT                                                  2255
C                                                                       2260
C      ***************************************************************  2265
C***(G) READ USABLE RECORD INTO A ARRAY.**********************************  2270
```

```
C                                                                       2275
  250 CALL TPRD (A,IPS,&280,&260)                                       2280
C                                                                       2285
C       IPS IS THE MAXIMUM SIZE OF THE ORIGINAL BCD RECORD. THIS SIZE   2290
C       / 200 IS THE MAXIMUM DISTANCE THE STYLUS CAN TRAVEL, + AND/OR -,2295
C       IN EITHER THE X OR THE Y DIRECTION; 60 IS THE END-OF-FILE EXIT, 2300
C       2 IS THE READ-ERROR EXIT.                                       2305
      GO TO 290                                                         2310
  260 WRITE (6,270) A(1),A(2),A(3),A(4)                                 2315
  270 FORMAT (5X,'THE ERROR STATISTICS TABLE IS ',4Z8)                   2320
  280 CONTINUE                                                          2325
  290 CONTINUE                                                          2330
C                                                                       2335
C       ***************************************************************2340
C***(H) MOVE BYTES OF A ARRAY INTO B ARRAY.*****************************2345
C                                                                       2350
      JJ = 0                                                            2355
      JJJ = 0                                                           2360
C                                                                       2365
CC                                                                      2370
C                                                                       2375
      DO 300 II=1,2000                                                  2380
C                                                                       2385
CC                                                                      2390
C                                                                       2395
      DO 300 I=1,4                                                      2400
      JJ = JJ+1                                                         2405
      CALL CHMOVE (A(II),I,B(JJ),4)                                     2410
      IF (B(JJ).EQ.DLR) GO TO 310                                       2415
C       END OF DATA DETECTED                                            2420
  300 CONTINUE                                                          2425
CC                                                                      2430
C                                                                       2435
  310 CONTINUE                                                          2440
C                                                                       2445
CC                                                                      2450
      B(8001) = DLR                                                     2455
C                                                                       2460
C       ***************************************************************2465
C***(I) PROCESS B ARRAY.************************************************2470
C                                                                       2475
C       A DIAGNOSTIC WRITE STATEMENT FOLLOWS:                           2480
      WRITE (6,320) JJ,(B(J),J=1,25)                                    2485
  320 FORMAT (/5X,'LABEL 320. ARRAY B IS FILLED; LOOK FOR MODE CHARACTER2490
     1. THE NUMBER OF ARRAY ELEMENTS PROCESSED INCLUDING STARS AND '/   2495
     25X,'DOLLARS, JJ= ',I5,/5X,'FIRST 25 CHARACTERS ARE: ',            2500
     3 10(1X,Z8)/5X,10(1X,Z8)/5X,5(1X,Z8)/)                            2505
C       TEST TO SEE IF THIS IS A KEYBOARD ENTRY OR A STAR (TRACER)      2510
```

```
C       AND PERMIT THE POSSIBILITY THAT EITHER 'KEYBOARD' OR 'TRACER'          2515
C       BUTTONS HAVE BEEN PUSHED TWICE.                                        2520
C                                                                              2525
C       IN USING THE CALMA DIGITIZER, SPURIOUS BLANK RECORDS WOULD             2530
C       APPEAR AT RANDOM THROUGHOUT THE TAPE. WHEN THESE BLANK RECORDS         2535
C       OCCUR DURING A HEADER RECORD NOTHING IS LOST SINCE HEADER              2540
C       INFO IS EASILY INSERTED VIA DATA CARDS BY SETTING IHDR=1.              2545
C       HOWEVER, IF A BLANK RECORD OCCURS DURING A TRACE RECORD THE            2550
C       COMPLETE STATION IS LOST.  FROM EXPERIENCE A BLANK RECORD              2555
C       NORMALLY WILL HAVE TWO CHARACTERS (IE. JJ=2). AFTER THE FIRST          2560
C       RUN THE BLANK RECORDS CAN BE LOCATED AND CAN THEN BE SKIPPED           2565
C       INDIVIDUALLY OR THE ENTIRE STATION CAN BE SKIPPED DEPENDING            2570
C       ON WHETHER THE BLANK RECORD IS IN THE HEADER OR TRACE.                 2575
C       THIS PROBLEM IS SUSPECTED TO BE THE RESULT OF MECHANICAL               2580
C       PROBLEMS WITH THE DIGITIZER ITSELF AND SHOULD NOT BE A                 2585
C       RECURRING PROBLEM.                                                     2590
      JJ = 1                                                                   2595
      GO TO 360                                                                2600
C                                                                              2605
C       THE FOLLOWING ROUTINE READS ANOTHER SET OF CARDS.  THIS IS THE         2610
C       ENTRY FOR THE SITUATIONS IN WHICH THE IRG IS MISSED.                   2615
  330 READ (5,140) LABEL,JSKIP,ISTOP,AMONC                                     2620
      IF (ISTOP.GT.0) GO TO 1370                                               2625
      IF (JSKIP.EQ.0) GO TO 340                                                2630
      READ (5,DAT)                                                             2635
      WRITE (6,150) LABEL                                                      2640
      WRITE (6,DAT)                                                            2645
      READ (5,CONTRL)                                                          2650
      WRITE (6,CONTRL)                                                         2655
C       DIAGNOSTIC WRITE STATEMENTS FOLLOW:                                    2660
  340 IPLACE = 185                                                             2665
      WRITE (6,180) (D(J),J=1,1801,20),IPLACE                                  2670
      WRITE (6,180) (T(J),J=1,1801,20),IPLACE                                  2675
      WRITE (6,190) JJJ,NE,KDTH1,KDTH2,JJJJ                                    2680
C                                                                              2685
      WRITE (6,350) NOIRG,JJJJ                                                 2690
  350 FORMAT (/5X,'LABEL 185.  PROCESSING SECOND HALF.  NOIRG=',I3,            2695
     1 'JJJJ=',I5/)                                                            2700
      NOIRG = 0                                                                2705
      JJ = JJJJ                                                                2710
C                                                                              2715
C       INITIALIZE ADDERS,ETC.                                                 2720
  360 SUMD = 0.                                                                2725
      SUMT = 0.                                                                2730
      N = 0                                                                    2735
      KL = 0                                                                   2740
C                                                                              2745
C       ***************************************************************        2750
```

```
C***(1) DECODE HEADER LABEL.*******************************************
C
C       DIAGNOSTIC WRITE STATEMENTS FOLLOW:
  370 FORMAT (/5X,'B(JJ)=',Z8/)
  380 FORMAT (5X,I5/)
      WRITE (6,380) JJ
      WRITE (6,370) B(JJ)
C       LOOK FOR KEYBOARD SYMBOL.
C       CHECK THE FIRST 11 VALUES OF THE B ARRAY FOR A KEYBOARD
C       SYMBOL SINCE IT IS POSSIBLE TO HAVE BAD OR INVALID SYMBOLS AHEAD
C      OF KEYBOARD SYMBOL OF HEADER. IF ALL ELEVEN VALUES ARE NOT KEYS,
C       RESET JJ TO 1 (IE.JJ=JJ-10) AND PROCESS AS A TRACE. HOWEVER
C       IF ONE OF THE VALUES 1 THRU 11 IS A KEY GO TO 264 AND
C       PROCESS AS A HEADER.
C       IF A TRACER SYMBOL IMMEDIATELY FOLLOWS A KEY SYMBOL, THE HEADER
C       IS PROBABLY MISSING AND THE SEGMENT IS PROSESSED AS A TRACE.
C       (NOTE 1: IN THE CASE OF A HEADER JJ IS NOT RESET TO 1.
  390 IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ-10
  400 FORMAT (5X,'LABEL 400.',I5)
      WRITE (6,400) JJ
      IF (KL.EQ.1) GO TO 430
      IF (KL.EQ.2) GO TO 430
C       NO KEYBOARD SYMBOL; MAY HAVE FORGOTTEN IT.  TEST THE 5TH AND
C       6TH SYMBOLS (IDEPTH).  IF BOTH ARE NINES CALL IT A KEYBOARD
C       ANYWAY.
      IF (B(5).EQ.NINE.AND.B(6).EQ.NINE) GO TO 410
      GO TO 590
```

```
  410 IJJ = JJ+12                                                        2995
      WRITE (6,420) (B(I),I=JJ,IJJ)                                      3000
  420 FORMAT (/5X,'AT 410, MISSING KEY.  B(1) TO B(13)=',13A1/)          3005
C                                                                        3010
CC     PROCESS KEYBOARD ENTRIES.  CHANGE THE WORDS TO                    3015
CC     INTEGER FORM BY SUBTRACTING Z404040F0 AND CREATE MULTI-DIGIT      3020
CC     INTEGERS.                                                         3025
CC     SKIP=T PERMITS NAMELIST DATA CARDS TO OVERRIDE TAPE HEADING       3030
C      INFO. ALL HEADING DATA MUST THEN BE PUT ON THE CARDS.             3035
  430 IF (SKIP) GO TO 540                                                3040
      ISTAA = 0                                                          3045
      IDENT = 0                                                          3050
C      DEFINE INDICES FOR DECODING THE LABEL                             3055
      KY1 = JJ                                                           3060
      KY2 = KY1+2                                                        3065
      KY3 = KY1+3                                                        3070
      KY4 = KY1+4                                                        3075
      KY5 = KY1+5                                                        3080
      KY6 = KY1+6                                                        3085
      KY7 = KY1+7                                                        3090
      KY8 = KY1+8                                                        3095
      KY9 = KY1+9                                                        3100
      KY10 = KY1+10                                                      3105
      KY11 = KY1+11                                                      3110
C                                                                        3115
CC     IF THERE IS A DLTREC IN THE HEADER, IT IS FOUND HERE. READ IN A   3120
CC     NEW RECORD, AND USE THE SAME CARDS.                               3125
CCC                                                                      3130
CCC                                                                      3135
C                                                                        3140
      DO 440 J=KY1,KY10                                                  3145
      IF (B(J).EQ.DLTREC) GO TO 450                                      3150
  440 CONTINUE                                                           3155
C                                                                        3160
CC                                                                       3165
C                                                                        3170
      GO TO 480                                                          3175
  450 WRITE (6,460)                                                      3180
  460 FORMAT (/5X,'DLTREC IN HEADER. REPEAT,USING SAME CARDS.')          3185
  470 IT = IT+1                                                          3190
      GO TO 170                                                          3195
C                                                                        3200
CC     DO THE CONVERSION, COMPARE WITH VALUES READ FROM THE CARDS,ACCEPT 3205
CC     THE CARDS.                                                        3210
C                                                                        3215
  480 CONTINUE                                                           3220
C                                                                        3225
CC                                                                       3230
```

```
C                                                                       3235
      DO 490 J=KY1,KY2                                                  3240
      B(J) = B(J)-ZER                                                   3245
      IB = B(J)                                                         3250
  490 ISTAA = ISTAA+IB*10**(KY2-J)                                      3255
C                                                                       3260
CC                                                                      3265
C                                                                       3270
      AMONT = B(KY3)                                                    3275
C                                                                       3280
CC                                                                      3285
C                                                                       3290
      DO 500 J=KY4,KY5                                                  3295
      B(J) = B(J)-ZER                                                   3300
      IB = B(J)                                                         3305
  500 IDENT = IDENT+IB*10**(J-KY4)                                      3310
C                                                                       3315
CC                                                                      3320
C                                                                       3325
      IDSC = B(KY6)-ZER                                                 3330
      ICOD = B(KY7)-ZER                                                 3335
      ITSCL1 = B(KY8)-ZER                                               3340
      ISCL1 = B(KY9)-ZER                                                3345
      IPP = B(KY10)-ZER                                                 3350
C                                                                       3355
C       IF THERE IS A DISAGREEMENT, WRITE A MESSAGE.                    3360
      IF (ISTAA.NE.ISTA) GO TO 520                                      3365
      IF (IDENT.NE.IDEN) GO TO 520                                      3370
      IF (IDSC.NE.IDSCL) GO TO 520                                      3375
      IF (ICOD.NE.ICODE) GO TO 520                                      3380
      IF (ITSCL1.NE.ITSCL) GO TO 520                                    3385
      IF (ISCL1.NE.ISCL) GO TO 520                                      3390
      IF (IPP.NE.IP) GO TO 520                                          3395
  510 FORMAT (5X,'LABEL=510.  CARD INPUTS EQUALLED TAPE HEADER FOR      3400
     1 STATION ',I3,A1/5X,'IDEPTH= ',I3/)                               3405
      WRITE (6,510) ISTA,AMONC,IDEN                                     3410
      GO TO 540                                                         3415
  520 WRITE (6,530) ISTA,AMONC,IDEN,IDSCL,ICODE,ITSCL,ISCL,IP,ISTAA,AMON3420
     1T,IDENT,IDSC,ICOD,ITSCL1,ISCL1,IPP                                3425
  530 FORMAT (/3X'CARD AND TAPE DISAGREE, CARD ON TOP'/3X,'   ISTA  AMON3430
     1C IDENT   IDSCL  ICODE  ITSCL   ISCL    IP'/3X,I7,A7,6I7/3X,I7,  3435
     2 A4,I10,5I7/)                                                     3440
C       WRITE THE RESULTS                                               3445
  540 WRITE (6,550) ISTA,AMONC,IDEN                                     3450
  550 FORMAT (5X,'LABEL 550.  HEADER PROCESSING COMPLETE EXCEPT SEARCH  3455
     1  FOR ERRORS ON STATION ',I3,A1/5X,'IDEN= ',I3/)                  3460
C                                                                       3465
C       CONSIDER IT POSSIBLE THAT NO IRG EXISTS AFTER THE HEADER.       3470
```

```
C       THE PROGRAM HAS FILLED THE B ARRAY WITH BOTH THE HEADER AND          3475
C       TEMPERATURE TRACE. ASSUME THERE IS A TRACER SYMBOL IN POS-           3480
C       ITION 12. IF THIS IS SO, CONTINUE TO PROCESS THE B ARRAY.            3485
        IF (B(KY11).NE.STAR) GO TO 570                                       3490
        JJJJ = KY11                                                          3495
        WRITE (6,560)                                                        3500
  560 FORMAT (/5X,'NO IRG AFTER HEADER; CONTINUE TO PROCESS B ARRAY.'/)      3505
        GO TO 330                                                            3510
  570 IF (IHDR.EQ.0) GO TO 1360                                              3515
C                                                                            3520
C       THIS BRANCH RETURNS TO 120 IF THE HEADER IS MISSING. SET IHDR=1      3525
C       ON THE CARD.                                                         3530
        WRITE (6,580)                                                        3535
  580 FORMAT (/5X,'HEADER MISSING; INFO INSERTED WITH CARDS.'/)              3540
        IHDR = 0                                                             3545
        GO TO 120                                                            3550
C                                                                            3555
C       ***************************************************************    3560
C***(2) PROCESS TRACE BY SUMMING X AND Y.*****************************      3565
C                                                                            3570
C       THE FOLLOWING PROCEDURE PERMITS THE PRESENCE OF ANY REASONABLE       3575
C       NUMBER OF TRACER SYMBOLS (STAR) INCLUDING NONE.                      3580
  590 NE = 0                                                                 3585
        NF = 0                                                               3590
        NSTAR = 0                                                            3595
  600 IF (B(JJ).EQ.STAR) GO TO 620                                           3600
C                                                                            3605
C       COUNT STARS AND WRITE MESSAGE                                        3610
        WRITE (6,610) NSTAR                                                  3615
  610 FORMAT (/5X,'START TRACER MODE; NO. OF TRACER SYMBOLS =',I2/)          3620
C       WHEN THERE ARE NO MORE STARS, START TESTING FOR COUNT SYMBOLS ETC    3625
        GO TO 630                                                            3630
  620 JJ = JJ+1                                                              3635
        NSTAR = NSTAR+1                                                      3640
C       CONTINUE TO TEST FOR STARS UNTIL NO MORE APPEAR.                     3645
        GO TO 600                                                            3650
C                                                                            3655
C       THE NEXT BLOCK OF OPERATIONS TO JUST BEYOND 820 LOOPS BACK TO        3660
C       630 CONTINUALLY, TESTING EACH CHARACTER FOR IDENTITY AND             3665
C       CONTINUING TO ADD OR SUBTRACT FROM THE CUMULATIVE Y AND X COUNTS     3670
C       UNTIL A DELETE-RECORD SYMBOL OR A STAR OR A DOLLAR INDICATES         3675
C       THE END OF DATA. THE FLAG IS PLACED AT THE POINT WHERE THE TRACE     3680
C       ACTUALLY BEGINS TO RECORD T VS D. PREVIOUS COUNTS RESULT             3685
C       FROM THE TRACER TRAVELING FROM THE COORDINATE ORIGIN TO THIS         3690
C       POINT.                                                               3695
  630 IF (B(JJ).EQ.ONE) GO TO 650                                            3700
        IF (B(JJ).EQ.BLANK) GO TO 660                                        3705
        IF (B(JJ).EQ.MINUS) GO TO 670                                        3710
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```
      IF (B(JJ).EQ.FLAG) GO TO 820                                          3715
      IF (B(JJ).EQ.KEY) GO TO 390                                           3720
C      THE NEXT GROUP OF STATEMENTS ALLOW FOR OCCASIONAL COUNTS GREATER      3725
C      THAN + OR - 1.                                                        3730
      IF (B(JJ).EQ.TWO) GO TO 680                                           3735
      IF (B(JJ).EQ.THREE) GO TO 690                                         3740
      IF (B(JJ).EQ.FOUR) GO TO 700                                          3745
      IF (B(JJ).EQ.FIVE) GO TO 710                                          3750
      IF (B(JJ).EQ.SIX) GO TO 720                                           3755
      IF (B(JJ).EQ.SEVEN) GO TO 730                                         3760
      IF (B(JJ).EQ.EIGHT) GO TO 740                                         3765
      IF (B(JJ).EQ.NINE) GO TO 750                                          3770
      IF (B(JJ).EQ.TEN) GO TO 760                                           3775
      IF (B(JJ).EQ.ELEVEN) GO TO 770                                        3780
      IF (B(JJ).EQ.MTWO) GO TO 780                                          3785
      IF (B(JJ).EQ.MTHREE) GO TO 790                                        3790
      IF (B(JJ).EQ.MFOUR) GO TO 800                                         3795
      IF (B(JJ).EQ.MFIVE) GO TO 810                                         3800
      IF (B(JJ).EQ.DLTREC) GO TO 920                                        3805
      WRITE (6,640) B(JJ)                                                   3810
  640 FORMAT (//5X,'SYMBOL NOT RECOGNIZED = ',Z8//)                         3815
C      WE ELIMINATE PRINTING OF THIS STATION AND INITIALIZE VARIABLES       3820
C      IF IP ALSO IS EQUAL TO 1.                                            3825
      IF (IP.EQ.1) GO TO 1330                                               3830
      GO TO 1360                                                            3835
  650 RX = 1.                                                               3840
      GO TO 860                                                             3845
  660 RX = 0.                                                               3850
      GO TO 860                                                             3855
  670 RX = -1.                                                              3860
      GO TO 860                                                             3865
  680 RX = 2.                                                               3870
      GO TO 860                                                             3875
  690 RX = 3.                                                               3880
      GO TO 860                                                             3885
  700 RX = 4.                                                               3890
      GO TO 860                                                             3895
  710 RX = 5.                                                               3900
      GO TO 860                                                             3905
  720 RX = 6.                                                               3910
      GO TO 860                                                             3915
  730 RX = 7.                                                               3920
      GO TO 860                                                             3925
  740 RX = 8.                                                               3930
      GO TO 860                                                             3935
  750 RX = 9.                                                               3940
      GO TO 860                                                             3945
  760 RX = 10.                                                              3950
```

```
      GO TO 860                                                          3955
  770 RX = 11.                                                           3960
      GO TO 860                                                          3965
  780 RX = -2.                                                           3970
      GO TO 860                                                          3975
  790 RX = -3.                                                           3980
      GO TO 860                                                          3985
  800 RX = -4.                                                           3990
      GO TO 860                                                          3995
  810 RX = -5.                                                           4000
      GO TO 860                                                          4005
  820 JJJ = NE                                                           4010
      JJ = JJ+1                                                          4015
      FG = 1                                                             4020
      GO TO 630                                                          4025
C      CHECK HERE FOR MULTIPLE KEYBOARD SYMBOLS. IF NUMBER EXCEEDS       4030
C      EIGHT TERMINATE THE PROGRAM. THE NUMBER EIGHT IS ARBITRARY.       4035
C      SELDOM DOES ONE GET MORE THAN THREE KEYBOARD SYMBOLS ON THE TAPE   4040
C      ACCIDENTALLY.                                                     4045
  830 WRITE (6,840)                                                      4050
  840 FORMAT (5X,'FOUND EIGHT KEYBOARD SYMBOLS IN SEQUENCE.  STOP.')     4055
      GO TO 1360                                                         4060
  850 KL = KL+1                                                          4065
      JJ = JJ+1                                                          4070
      IF (KL.EQ.8) GO TO 830                                             4075
      IF (B(JJ).EQ.STAR) GO TO 590                                       4080
C      TRY AGAIN                                                         4085
      GO TO 390                                                          4090
C                                                                        4095
C      THE ADDING IS DONE HERE AND THE CUMULATIVE SUM STORED, ONE        4100
C      UNIT PER .01 INCH.                                                4105
  860 N = N+1                                                            4110
      NE = N/2                                                           4115
      NF = NE*2                                                          4120
      IF (NF.EQ.N) GO TO 870                                             4125
C      THIS FIDDLING AROUND DETERMINES IF  THE COUNT IS EVEN OR ODD.     4130
C      START COUNTING IN THE ORDER YXYX (BECAUSE THE CHART IS READ       4135
C      SIDEWAYS.  X AND Y IN THIS PROGRAM HAVE THE NORMAL ORIENTATIONS   4140
C      ON THE STRIP CHART.  THEY ARE INVERTED WITH RESPECT TO THE        4145
C      CALMA DIGITIZER. SPECIFICALLY DEPTH DECREASES ALONG THE           4150
C      POSITIVE X AXIS AND TEMP INCREASES ALONG THE POSITIVE Y AXIS      4155
C      ON THE CALMA DIGITIZER.                                           4160
C                                                                        4165
C      IF ODD                                                            4170
      SUMD = SUMD+RX                                                     4175
C      INCREASE THE ODD INDEX TO KEEP IT THE SAME AS THE EVEN.           4180
      NE = NE+1                                                          4185
      Y(NE) = SUMD                                                       4190
```

```
      JJ = JJ+1                                                          4195
      GO TO 880                                                          4200
C                                                                        4205
C       IF EVEN                                                          4210
  870 SUMT = SUMT+RX                                                     4215
      X(NE) = SUMT                                                       4220
      JJ = JJ+1                                                          4225
C       IF A STAR OR DOLLAR IS FOUND, THIS IS THE END OF THE DATA.       4230
  880 IF (B(JJ).EQ.DLR) GO TO 940                                        4235
C       END NORMAL TRACE PROCESSING                                      4240
C                                                                        4245
C       BEGIN TROUBLE SHOOTING                                           4250
C       IF THERE IS NO IRG BETWEEN TRACES BUT THERE IS A TRACER SYMBOL,  4255
C       THE TWO CAN BE SEPARATED BY FIRST SETTING                        4260
C       NOIRG=1, DOING NORMAL PROCESSING ON THE FIRST PART OF THE        4265
C       B ARRAY, READING A NEW SET OF CARDS, AND THEN PROCESSING THE     4270
C       SECOND PART OF B.                                                4275
      IF (B(JJ).NE.STAR) GO TO 900                                       4280
      NOIRG = 1                                                          4285
C       SAVE THE INDEX OF THE START OF THE SECOND HALF, JJJJ.            4290
      JJJJ = JJ                                                          4295
      WRITE (6,890)                                                      4300
  890 FORMAT (/5X,'FOUND A STAR AT END OF TRACER ASSUME THERE IS NO IRG.  4305
     1'/5X,'PROCESS RECORD IN TWO PARTS, READING CARDS FOR BOTH PARTS.'/ 4310
     2)                                                                  4315
      GO TO 940                                                          4320
  900 IF (B(JJ).NE.KEY) GO TO 630                                        4325
      JJJJ = JJ                                                          4330
      WRITE (6,910)                                                      4335
  910 FORMAT (/5X,'FOUND A KEYBOARD SYMBOL.  PROCESS NEXT PORTION OF B A 4340
     1RRAY AFTER READING NEW CARDS.'/)                                   4345
      NOIRG = 1                                                          4350
      GO TO 940                                                          4355
C                                                                        4360
  920 WRITE (6,930) JJ                                                   4365
  930 FORMAT (5X,'FOUND DELETE RECORD SYMBOL AT JJ= ',I5)                4370
C       IF DELETE RECORD IS FOUND, GO TO 470  AND INCREMENT THE          4375
C       VARIABLE, IT, BUT RETURN TO STATEMENT 170. A NEW SET OF CARDS    4380
C       IS NOT READ BUT THE RECORD COUNT, IT, IS INCREMENTED.            4385
      GO TO 470                                                          4390
  940 JJ = JJ-1                                                          4395
C                                                                        4400
C       END TRACER AND ASSOCIATED TROUBLE SHOOTING                       4405
C                                                                        4410
C       ************************************************************     4415
C***(J) CONVERT X AND Y ARRAYS TO DEPTH AND TEMPERATURE.****************  4420
C                                                                        4425
      WRITE (6,950) JJJ,NE,Y(NE),X(NE)                                   4430
```

```
  950 FORMAT (/5X,'LABEL 950.  START CONDENSING UNCONVERTED ARRAY AND CO     4435
     1NVERTING TO SCIENTIFIC UNITS.'/5X,'THE TRACER ENTERED THE FRAME (F    4440
     2LAG) AT JJJ= ',I5/5X,'THE END OF THE TRACE HAS INDEX NE= ',I5/        4445
     3 5X,'LAST (UNCONVERTED) DEPTH AND TEMP ARE: ',F7.1,2X,F7.1/)          4450
C                                                                           4455
CC                                                                          4460
C      CHECK TO SEE IF FLAG WAS FOUND.                                      4465
       IF (FG.EQ.1) GO TO 970                                               4470
       WRITE (6,960)                                                        4475
  960 FORMAT (/5X,'NO FLAG FOUND; PROCESS ANYWAY.'/)                        4480
  970 WRITE (6,980)                                                         4485
  980 FORMAT (' ')                                                          4490
       FG = 0                                                               4495
C                                                                           4500
CC     THE X AND Y ARRAYS ARE FILLED AND THE START AND END OF THIS BATCH    4505
C      OF DATA ARE LABELED WITH JJJ AND NE. THE ARRAYS ARE INDEXED          4510
C      ON  0.01 INCH DEPTH SPACING. SUBROUTINE CONDNS INTERPOLATES TO       4515
C      FILL ANY BLANK ARRAY POSITIONS.                                      4520
       CALL CONDNS (X,Y,T,JJJ,NE,KDTH1,KDTH2)                               4525
C                                                                           4530
CC                                                                          4535
C                                                                           4540
       DO 1060 J=KDTH1,KDTH2                                                4545
       D(J) = (J-1)/DCON(IDSCL)+DCOR                                        4550
C      SUBROUTINE WLQP2, LOCATED IN THE SUBROUTINE LIBRARY OF THE W. R.     4555
C      CHURCH COMPUTER CENTER WAS USED TO DETERMINE THE COEFFICIENTS        4560
C      FOR A BEST FIT SECOND DEGREE POLYNOMIAL THAT DESCRIBED THE           4565
C      RELATIONSHIP BETWEEN THE TEMP AND THE MOVEMENT OF THE STYLUS         4570
C      AS MEASURED IN HUNDREDS OF INCHES.                                   4575
C      A SINGLE POLYNOMIAL DID NOT ACCURATELY DESCRIBE                      4580
C      THIS RELATIONSHIP. IT WAS NECESSARY TO BREAK THE TRACE INTO          4585
C      FIVE SEGMENTS. THE FIRST EQUATION WAS DETERMINED FOR TEMPS FROM      4590
C      1 TO 5 DEG., THE NEXT EQUATION FROM 5 TO 10 DEG., ETC, UP TO A       4595
C      MAXIMUM OF 25 DEG. BY USING SEGMENTS THE EQUATIONS ARE ACCURATE      4600
C      TO WITHIN AT LEAST 0.01 DEG.                                         4605
C                                                                           4610
C      TCOR IS A TEMP CORRECTION WHICH MAY BE APPLIED TO A SINGLE           4615
C      STATION IF NECESSARY. A SINGLE STATION MAY BE IN ERROR DUE           4620
C      TO IMPROPER DIGITIZING TECHNIC. IF THE OPERATOR STARTS TO            4625
C      TRACE AT A POINT WHICH IS NOT THE ORIGIN A CONSTANT CORR. CAN        4630
C      SHIFT THE TRACE BACK TO THE ORIGIN.                                  4635
C      XBTCOR IS A CORRECTION DESIGNED TO MAKE THE XBT READING              4640
C      AGREE WITH A STANDARD, EITHER WITH A NANSEN CAST OR A                4645
C      STANDARDIZED STD TRACE WHICH WAS MADE AT THE SAME TIME.              4650
C      GENERALLY THE XBT TEMP WAS NOTICABLY HIGHER THAN THE TEMPS           4655
C      RECORDED BY THE OTHER TWO METHODS. THIS CORRECTION ENABLES ONE TO    4660
C      COMPARE TEMPS TAKEN BY DIFFERENT METHODS.                            4665
C                                                                           4670
```

```
      IF (T(J).LT.16.6) WRITE (6,990)                                    4675
  990 FORMAT (/5X,'T(J) LESS THEN 1.0 DEG')                              4680
      IF (T(J).LT.16.6) GO TO 1060                                       4685
      IF (T(J).GT.88.2) GO TO 1000                                       4690
      T(J) = .0509421+.057236*T(J)-.0000125*T(J)*T(J)+TCOR+XBTCOR        4695
      GO TO 1060                                                         4700
 1000 IF (T(J).GT.182.8) GO TO 1010                                      4705
      T(J) = .179875+.0556283*T(J)-.0000104*T(J)*T(J)+TCOR+XBTCOR        4710
      GO TO 1060                                                         4715
 1010 IF (T(J).GT.280.2) GO TO 1020                                      4720
      T(J) = .520519+.0522706*T(J)-.0000021*T(J)*T(J)+TCOR+XBTCOR        4725
      GO TO 1060                                                         4730
 1020 IF (T(J).GT.378.8) GO TO 1030                                      4735
      T(J) = 2.18667+.042103*T(J)+.0000129*T(J)*T(J)+TCOR+XBTCOR         4740
      GO TO 1060                                                         4745
 1030 IF (T(J).GT.475.6) GO TO 1040                                      4750
      T(J) = 2.55982+.0415735*T(J)+.0000118*T(J)*T(J)+TCOR+XBTCOR        4755
      GO TO 1060                                                         4760
 1040 IF (T(J).GT.475.6) WRITE (6,1050)                                  4765
 1050 FORMAT (/5X,' T(J) EXCEEDS 25 DEG.')                               4770
 1060 CONTINUE                                                           4775
C                                                                        4780
CCC                                                                      4785
CCC                                                                      4790
C     ************************************************************       4795
C***(K) MANUALLY INSERT SURFACE AND NEAR SURFACE VALUES.***************  4800
C                                                                        4805
C     THE T ARRAY IS NOW CONVERTED, AND IT IS NOW NECESSARY              4810
C     TO REINSERT SURFACE AND NEAR SURFACE DATA.  NORMALLY, ONLY         4815
C     SURFACE VALUES  NEED TO BE INSERTED DUE TO THE DIGITIZER OPERATOR  4820
C     BEGINNING HIS TRACING SLIGHTLY BELOW HIS ZERO DEPTH REFERENCE.     4825
C     SURFACE VALUES ARE INSERTED BY CHECKING THE VALUE OF IH.           4830
C     IF IH EQUALS ZERO, NO DATA IS INSERTED MANUALLY. IF IH=1,SURFACE   4835
C     DEPTH AND TEMPERATURE ARE INSERTED VIA &DAT DATA CARD FOR THE      4840
C     PARTICULAR STATION. THIS HAND ENTERED DATA IS STORED IN THE        4845
C     DH AND TH ARRAYS. INFREQUENTLY IT MAY BE NECESSARY TO MANUALLY     4850
C     INSERT DATA VALUES FOR DEPTHS AT NEAR SURFACE.                     4855
C     THIS IS AGAIN NECESSARY ONLY IF THE                                4860
C     DIGITIZER OPERATOR BEGAN DIGITIZING WELL BELOW THE ZERO DEPTH      4865
C     REFERENCE. SINCE THIS OCCURS INFREQUENTLY AND INVOLVES A SIGNIF-   4870
C     ICANT AMOUNT OF WORK TO MANUALLY INSERT THE DATA VIA CARDS, THIS   4875
C     OPERATION IS PERFORMED ONLY WHEN WRITING THE COMPOSITE TAPE AND    4880
C     CONSEQUENTLY ONLY WHEN ISQZ=1.THUS TO INSERT NEAR SURFACE DATA     4885
C     IHMUSTBEGREATERTHANOREQUALTO2ANDISQZ=1.DHANDTHARE                  4890
C     DIMENSIONED AT 12 , WHICH EQUATES TO APPROXIMATELY 10.5 METERS AT  4895
C     ISQZ=1.  ISQZ=1 WAS CHOSEN BECAUSE ALL OF THE ELEMENTS OF THE D,T  4900
C     ARRAYS ARE PRINTED AS OUTPUT VIA OUT2. THIS ELIMINATES "GUESSWORK  4905
C     WITH RESPECT TO WHICH VALUES NEED TO BE INSERTED, SINCE ALL        4910
```

```
C       VALUES ARE INSERTED.  IF THERE IS A GAP BETWEEN HAND ENTERED          4915
CC      DATA AND XBT DATA , IT IS NOT FILLED.                                 4920
C                                                                             4925
      IF (IH.EQ.0) GO TO 1080                                                 4930
      T(1) = TH(1)                                                            4935
      IF (IH.LT.2) GO TO 1080                                                 4940
      IF (ISQZ.GT.1) GO TO 1080                                               4945
C                                                                             4950
CCC                                                                           4955
C                                                                             4960
      DO 1070 J=2,IH                                                          4965
      D(J) = DH(J)                                                            4970
      T(J) = TH(J)                                                            4975
 1070 CONTINUE                                                                4980
C                                                                             4985
CCC                                                                           4990
C                                                                             4995
 1080 CONTINUE                                                                5000
C                                                                             5005
CC    DIAGNOSTIC WRITE STATEMENTS FOLLOW:                                     5010
C-------------------                                                          5015
      IPLACE = 1080                                                           5020
      WRITE (6,180) (D(J),J=1,1801,20),IPLACE                                 5025
      WRITE (6,180) (T(J),J=1,1801,20),IPLACE                                 5030
      WRITE (6,190) JJJ,NE,KDTH1,KDTH2,JJJJ                                   5035
C-------------------                                                          5040
CCC                                                                           5045
CC     ***************************************************************      5050
C***(L) ELIMINATE UNWANTED DATA.*************************************         5055
CC                                                                            5060
CC      IN DIGITIZING TEMP SEGMENTS ONE FREQUENTLY GETS UNUSUAL VALUES        5065
CC      AT THE TOP OR BOTTOM OF THE TRACE SEGMENT (ZERO OR VERY HIGH). IT     5070
CC      IS DESIRABLE THAT THESE UNWANTED VALUES BE ELIMINATED PRIOR TO        5075
CC      WRITING A TAPE OR PUNCHING CARDS. THUS A CHECK IS MADE TO SEE         5080
CC      IF T(J) IS ZERO OR GREATER THAN 25.                                   5085
CC                                                                            5090
CC      THESE VALUES ARE WRITTEN OUT                                          5095
CC      AND COUNTED FOR RECORD PURPOSES BUT ARE DISCARDED FROM THE            5100
CC      D AND T ARRAYS. NOTE THE VALUE OF KDTH2, WHICH IS EQUAL TO THE        5105
CC      TOTAL NUMBER OF RECORDS, IS REDUCED BY THE NUMBER OF UNWANTED         5110
C       RECORDS.                                                              5115
      K = 0                                                                   5120
      L = 1                                                                   5125
C                                                                             5130
CCC                                                                           5135
C                                                                             5140
      DO 1110 J=1,KDTH2                                                       5145
      IF ((T(J).EQ.0.0).OR.(T(J).GT.25.0)) GO TO 1090                         5150
```

```
      D(L) = D(J)                                                        5155
      T(L) = T(J)                                                        5160
      L = L+1                                                            5165
      GO TO 1110                                                         5170
 1090 WRITE (6,1100) D(J),T(J),J                                         5175
      K = K+1                                                            5180
      JSAV = K                                                           5185
 1100 FORMAT (//5X,2F7.2,I6,//)                                          5190
 1110 CONTINUE                                                           5195
C                                                                        5200
CC                                                                       5205
C                                                                        5210
 1120 FORMAT (//5X,' JSAV=',I6,//)                                       5215
      WRITE (6,1120) JSAV                                                5220
      KDTH2 = KDTH2-JSAV                                                 5225
C                                                                        5230
C      ************************************************************      5235
C***(M) GENERATE SERIAL NUMBERS FOR TAPE OUTPUT.**********************     5240
C                                                                        5245
C      GENERATE SERIAL NUMBERS FOR THE RECORDS. A RECORD IS              5250
C      EITHER A HEADER FOR A STATION OR THE VALUES  (D AND T) FOR        5255
C      A SINGLE DEPTH.                                                   5260
CC                                                                       5265
CC                                                                       5270
C                                                                        5275
      DO 1130 J=1,KDTH2                                                  5280
      JREC = JREC+1                                                      5285
      IREC(J) = JREC                                                     5290
 1130 CONTINUE                                                           5295
C                                                                        5300
CC                                                                       5305
C                                                                        5310
C      ************************************************************      5315
C***(N) CONVERT LETTER CODE TO MONTH/YEAR.****************************    5320
C                                                                        5325
C      THIS SECTION CONVERTS THE LETTER DESIGNATOR FOR MONTH (AMONC)     5330
C      FROM THE SINGLE LETTER CODE ON THE DIGITIZED TAPE TO THE          5335
C      APPROPRIATE MONTH AND YEAR IN PREPARATION FOR WRITING THE OUTPUT. 5340
CC                                                                       5345
CC                                                                       5350
C                                                                        5355
      DO 1140 J=1,13                                                     5360
      IF (AMONC.EQ.AMONCA(J)) GO TO 1160                                 5365
 1140 CONTINUE                                                           5370
C                                                                        5375
CC                                                                       5380
C                                                                        5385
 1150 FORMAT (15X,'AMONC NEVER DID EQUAL AMONC(J) CONSEQUENTLY,          5390
```

```
     1 WMONTH WILL NOT BE DEFINED'/)                                          5395
       WRITE (6,1150)                                                        5400
       GO TO 1170                                                            5405
 1160 WMONTH = EVENT(J)                                                      5410
 1170 CONTINUE                                                               5415
C                                                                            5420
C      ***************************************************************       5425
C***(O) OUTPUT.*************************************************************5430
C                                                                            5435
C      PRINT DATA                                                            5440
C                                                                            5445
C      THE PARAMETER ISQZ PERMITS CONDENSING THE PRINTED DATA BY THE         5450
C      FACTOR ISQZ                                                           5455
C                                                                            5460
       IF (.NOT.PRT1) GO TO 1190                                             5465
C                                                                            5470
       WRITE (6,1180)                                                        5475
 1180 FORMAT ('1')                                                           5480
       CALL OUT2 (O,T,KDTH2,ISTA,WMONTH,IREC,JREC,ISQZ)                      5485
C                                                                            5490
C      WRITE TAPE                                                            5495
C                                                                            5500
C      TAPE MUST BE TRUE ONLY ONCE, AT THE BEGINNING OF TAPE  WRITING.       5505
C      THE PROGRAM EXPECTS JCL TO WRITE CARD IMAGES ON THE TAPE              5510
C      IN RECORDS 20 DIGITS LONG.                                            5515
 1190 IF (.NOT.TAPE) GO TO 1230                                              5520
C      WRITE THE HEADER INFO HERE.                                           5525
       WRITE (8,1200) ISTA,WMONTH,KDTH2                                      5530
 1200 FORMAT (I4,A9,I6)                                                      5535
       WRITE (8,1210) (O(J),T(J),J=1,KDTH2)                                  5540
 1210 FORMAT (F8.2,F6.2)                                                     5545
       WRITE (6,1220) ISTA,WMONTH,JREC                                       5550
 1220 FORMAT (5X,'DATA FOR STATION ',I5,A12,' WRITTEN ON TAPE UP TO          5555
     1  RECORD ',I6)                                                         5560
C                                                                            5565
C      PUNCH CARDS                                                           5570
C                                                                            5575
C      COMPRESS THE PUNCHED DATA BY A FACTOR ICSQZ. FORMAT FOR FOUR          5580
C      DATA SETS ON A CARD. NPTS  BECOMES THE NUMBER OF DATA PRINTED         5585
C      IF IT IS EVENLY DIVISIBLE. OTHERWISE THE LAST DATUM IS ALSO           5590
C      PUNCHED. SUPPLY JCL FOR CARD PUNCHING.                                5595
C                                                                            5600
 1230 IF (.NOT.CARDS) GO TO 1330                                             5605
C                                                                            5610
C      THE NUMBER OF POINTS TO BE RETAINED AFTER CONDENSATION IS             5615
C      1+(N-1)/ISQZ. IF THIS DOES NOT COME OUT INTEGRAL ADD THE LAST         5620
C      POINTS.                                                               5625
       NPTS = (KDTH2-1)/ICSQZ                                                5630
```

```
      NPT1 = KDTH2-1-ICSQZ*NPTS                                          5635
      NPTS = NPTS+1                                                      5640
C      WRITE A HEADER CARD                                               5645
 1240 FORMAT (14X,'OCEANOGRAPHIC DATA FROM U C M II',//)                 5650
 1250 FORMAT (1X,I4,' VALUES OF D,T FOR XBT STA.',I3,A8,'COMPRESSED BY', 5655
     1 I3,/)                                                             5660
 1260 FORMAT (4X,'DEPTH',2X,'TEMP.',2X,'DEPTH',2X,'TEMP.',2X,'DEPTH',    5665
     1 2X,'TEMP.',2X,'DEPTH',2X,'TEMP.')                                 5670
 1270 FORMAT (4X,'METERS',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',1X,'METERS 5675
     1',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',/)                           5680
      WRITE (7,1240)                                                     5685
      WRITE (7,1250) NPTS,ISTA,WMONTH,ICSQZ                              5690
      WRITE (7,1260)                                                     5695
      WRITE (7,1270)                                                     5700
C      NOW FIND THE NUMBER OF CARDS                                      5705
      NCARDS = NPTS/4                                                    5710
      NCRD1 = NPTS-4*NCARDS                                              5715
C      THERE WILL BE ONE MORE CARD IF NCRD1.NE.0.                        5720
      INCR = 4*ICSQZ                                                     5725
      J = 1-INCR                                                         5730
      K = 0                                                              5735
 1280 J = J+INCR                                                         5740
      K = K+1                                                            5745
      J1 = J+ICSQZ                                                       5750
      J2 = J1+ICSQZ                                                      5755
      J3 = J2+ICSQZ                                                      5760
 1290 FORMAT (2X,4(F8.2,F6.2),3X,I3,A10,I6)                              5765
      WRITE (7,1290) D(J),T(J),D(J1),T(J1),D(J2),T(J2),D(J3),T(J3),ISTA, 5770
     1WMONTH,JREC                                                        5775
      IF (K.LT.NCARDS) GO TO 1280                                        5780
      IF (NCRD1.EQ.0) GO TO 1320                                         5785
C      WRITE THE LAST CARD                                               5790
      J = J3+ICSQZ                                                       5795
      WRITE (7,1290) D(J),T(J)                                           5800
      IF (J.EQ.KDTH2) GO TO 1320                                         5805
      J = J+ICSQZ                                                        5810
 1300 FORMAT (1H+,16X,F8.2,F6.2)                                         5815
      WRITE (7,1300) D(J),T(J)                                           5820
      IF (J.EQ.KDTH2) GO TO 1320                                         5825
      J = J+ICSQZ                                                        5830
 1310 FORMAT (1H+,30X,F8.2,F6.2)                                         5835
      WRITE (7,1310) D(J),T(J)                                           5840
 1320 CONTINUE                                                           5845
C                                                                        5850
 1330 IF (ENDFL) END FILE 8                                              5855
C      ENDFL MUST BE TRUE ONCE ON THE LAST TAPE WRITING OPERATION.       5860
C                                                                        5865
C      ***************************************************************** 5870
```

```
C***(P) INITIALIZE VARIABLES FOR NEXT STATION.**************************
C
      JREC = JREC+1
C
C
C
      DO 1340 J=1,1801
      D(J) = 0.
      T(J) = 0.
 1340 CONTINUE
C
C
C
C
      DO 1350 J=1,12
      TH(J) = 0.
      DH(J) = 0.
 1350 CONTINUE
C
C
C
      SKIP = .FALSE.
      IDEN = 0
      IH = 0
      IP = 0
      JSAV = 0
      IF (NOIRG.EQ.1) GO TO 330
C
 1360 IT = IT+1
      GO TO 120
 1370 STOP
      END
```

```
C      ----------------SUBROUTINE OUT2 --------------------
C      THIS OUTPUT SUBROUTINE FOR DIGIXBT PRINTS DEPTHS AND TEMPS
C      FOUR COLUMNS TO A PAGE.
C
      SUBROUTINE OUT2 (D,T,KDTH2,ISTA,WMONTH,IREC,JREC,ISQZ)
      REAL *8WMONTH
      DIMENSION D(1801), T(1801), IREC(1801)
C       PRODUCE HEADING
   20 FORMAT (14X,'OCEANOGRAPHIC DATA FROM U C M II',//)
   30 FORMAT (1X,I4,' VALUES OF D,T FOR XBT STA.',I3,A8,'COMPRESSED BY',
     1 I3,/)
```

```
   40 FORMAT (4X,'DEPTH',2X,'TEMP.',2X,'DEPTH',2X,'TEMP.',2X,'DEPTH',
     1 2X,'TEMP.',2X,'DEPTH',2X,'TEMP.')
   50 FORMAT (4X,'METERS',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',1X,'METERS
     1',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',/)
      NPTS = NPTS+1
      INCR = 4*ISQZ
      NPTS = (KDTH2-1)/ISQZ
      WRITE (6,20)
      WRITE (6,30) NPTS,ISTA,WMONTH,ISQZ
      WRITE (6,40)
      WRITE (6,50)
C       COMPUTE NUMBER OF FULL LINES
      NLNS = (KDTH2-1+ISQZ)/INCR
      NLN1 = KDTH2-1-(4*NLNS-1)*ISQZ
      J = 1-INCR
      K = 0
   60 J = J+INCR
      K = K+1
      J1 = J+ISQZ
      J2 = J1+ISQZ
      J3 = J2+ISQZ
   70 FORMAT (2X,4(F8.2,F6.2),10X,2I6)
      WRITE (6,70) D(J),T(J),D(J1),T(J1),D(J2),T(J2),D(J3),T(J3),IREC(J)
     1,IREC(J3)
      IF (K.LT.NLNS) GO TO 60
C
      IF (NLN1.EQ.0) GO TO 120
C       WRITE THE LAST LINE
      J = J3+ISQZ
      WRITE (6,70) D(J),T(J)
      IF (J.EQ.KDTH2) GO TO 110
      J = J+ISQZ
   80 FORMAT (1H+,15X,F8.2,F6.2)
      WRITE (6,80) D(J),T(J)
      IF (J.EQ.KDTH2) GO TO 110
      J = J+ISQZ
   90 FORMAT (1H+,29X,F8.2,F6.2)
      WRITE (6,90) D(J),T(J)
  100 FORMAT (1H+,73X,I6)
  110 WRITE (6,100) IREC(J)
  120 CONTINUE
C
C       COUNT RECORDS
  130 FORMAT (//5X,'THIS STATION CONTAINS RECORDS ',I5,' TO ',I5,' INCLU
     1SIVE. '/)
      WRITE (6,130) IREC(1),JREC
  140 FORMAT (1H1)
      WRITE (6,140)
```

```
      RETURN                                                            300
      END                                                               305



C      ----------SUBROUTINE CONDNS----------                              5
C      THIS SUBROUTINE FINDS THE ARRAY LOCATIONS FOR X, INDEXED          10
C      SEQUENTIALLY FOR EACH UNIT OF Y.  EACH UNIT OF Y IS 1.0 AND       15
C      CORRESPONDS TO .01 INCHES OF TRAVEL IN THE DEPTH DIRECTION.       20
C                                                                        25
      SUBROUTINE CONDNS (X,Y,T,JJJ,NE,KDTH1,KDTH2)                      30
      DIMENSION X(1), Y(1), T(1), KINS(10), KNO(10)                     35
C      IF FIRST INDEX IS ZERO OR NEGATIVE THERE IS A MISBEHAVIOR ELSE-   40
C      WHERE IN THE PROGRAM.  RESET JJJ TO 1.                            45
      IF (JJJ.GE.1) GO TO 30                                            50
      JJJ = 1                                                           55
      WRITE (6,20)                                                      60
   20 FORMAT (/5X,'****** JJJ RESET TO ONE - SOMETHING WRONG ******'/)  65
C      KDTH1 BECOMES THE INDEX OF THE START OF THIS ARRAY SEGMENT.       70
   30 KDTH1 = Y(JJJ)+1.50                                               75
C      BUT IN CASE KDTH1 BECOMES ZERO OR LESS, USE THE START OF THE      80
C      CURVE AS THE ORIGIN OF INDEXING.                                  85
C      THIS CAUSES AN OVERLAP BETWEEN ARRAYS, BUT IT SHOULD BE SMALL.    90
      XINC = 0.                                                         95
      IF (KDTH1.GT.0) GO TO 40                                         100
      XINC = FLOAT(1-KDTH1)                                            105
      KDTH1 = 1                                                        110
C                                                                      115
   40 JJ1 = JJJ+1                                                      120
      NE1 = NE-1                                                       125
C      FORM SUBSCRIPTS FROM THE DEPTH INCREMENTS AND STORE X'S AT THOSE 130
C      ARRAY LOCATIONS.                                                135
C      SEARCH FOR BLANKS IN ARRAY BETWEEN INDEXES KDTH1 AND KDTH2.     140
C      KCT COUNTS THE NUMBER OF BLANKS                                 145
      KCT = 0                                                          150
      KSAV = KDTH1                                                     155
C      KINS(J) IS THE NUMBER OF THE ARRAY POSITION FILLED.             160
C                                                                      165
C                                                                      170
C                                                                      175
      DO 50 J=1,10                                                     180
      KNO(J) = 0                                                       185
   50 KINS(J) = 0                                                      190
C                                                                      195
C                                                                      200
C                                                                      205
```

```
C                                                                       210
      DO 80 J=JJ1,NE1                                                   215
      KDTH = Y(J)+1.50+XINC                                             220
      T(KDTH) = X(J)                                                    225
C      TEST TO SEE IF INDEX IS THE SAME OR ONE GREATER THAN THE LAST    230
C      ONE.  IF NOT, INTERPOLATE VALUES.                                235
      NREP = KDTH-KSAV                                                  240
      IF (NREP.LE.1) GO TO 70                                           245
      KCT = KCT+1                                                       250
      IF (KCT.GT.10) KCT = 10                                           255
      KNO(KCT) = NREP                                                   260
      KINS(KCT) = KDTH                                                  265
      II = KSAV+1                                                       270
      III = KDTH-1                                                      275
      E = FLOAT(NREP)                                                   280
      G = T(KDTH)                                                       285
      F = G-T(KSAV)                                                     290
C                                                                       295
CCC                                                                     300
                                                                        305
      DO 60 I=II,III                                                    310
   60 T(I) = (FLOAT(I-KSAV)/E)*F+G                                      315
C                                                                       320
CCC                                                                     325
                                                                        330
   70 KSAV = KDTH                                                       335
   80 CONTINUE                                                          340
C                                                                       345
CCC                                                                     350
CC                                                                      355
      KDTH2 = Y(NE)+1.50+XINC                                           360
C      PUT IN THE FIRST POINT, WHICH OTHERWISE WOULD BE THE LAST        365
C      ONE FOR WHICH Y(J).LT.1.                                         370
      T(KDTH1) = X(JJJ)                                                 375
      T(KDTH2) = X(NE)                                                  380
C      SAVE INDEX OF END OF ARRAY.                                      385
CC                                                                      390
C      WRITE DOWN NUMBER AND LOCATIONS OF INTERPOLATED VALUES.          395
      WRITE (6,90) KCT,(KINS(I),I=1,KCT),(KNO(I),I=1,KCT)              400
   90 FORMAT (/5X,'BLANK ARRAY POSITIONS FILLED IN ',I3,' PLACES.  BEGIN 405
     1NING INDEXES AND NO. OF STEPS'/5X,'(10 EACH) ARE: ',5X,10I6/      410
     2 5X,10I6/)                                                        415
      RETURN                                                            420
      END                                                               425
```

```
C      ---------------SUBROUTINE CHMOVE ------------------------------
       SUBROUTINE CHMOVE (A,I,B,J)
C       THIS SUBROUTINE RETURNS A LOGICAL*1 VARIABLE TO A 4-BYTE ADDRESS
C       IN THE MAIN PROGRAM, UNPACKING THE ORIGINAL 4-BYTE WORDS A
C       BYTE AT A TIME.
       LOGICAL *1A(1),B(1)
       B(J) = A(I)
       RETURN
       END
```

```
*      ..................................................................  TPR01300
*                                                                          TPR01310
          MACRO                                                            TPR01320
          REGS                                                             TPR01330
          LCLA  &N                                                         TPR01340
          LCLC  &SYM                                                       TPR01350
.LOOP     ANOP                                                             TPR01360
&SYM      SETC  'R&N'                                                      TPR01370
R&SYM     EQU   &SYM                                                       TPR01380
&N        SETA  &N+1                                                       TPR01390
          AIF   (&N LT 16).LOOP                                            TPR01400
          MEND                                                             TPR01410
          SPACE 2                                                          TPR01420
TPRD     CSECT                                                             TPR01430
          SPACE 2                                                          TPR01440
          REGS                                                             TPR01450
          SPACE 2                                                          TPR01460
          STM   R14,R12,12(R13)                                            TPR01470
          LR    R12,R15                                                    TPR01480
          USING TPRD,R12                                                   TPR01490
          LA    R11,SAV1        LINK  SAVE REGISTERS                       TPR01500
          ST    R13,4(R11)                                                 TPR01510
          ST    R11,8(R13)                                                 TPR01520
          LR    R13,R11                                                    TPR01530
          LR    R11,R1           GET ADDRESS OF ARGUMENT LIST              TPR01540
          USING ARGS,R11                                                   TPR01550
          L     R10,AADD                                                   TPR01560
          ST    R10,SHOVAAD      PUT IN LIST FOR SHOVE CALL                TPR01570
          L     R10,ALADD                                                  TPR01580
          L     R10,0(R10)       PUT LENGTH IN SAME LIST                   TPR01590
          ST    R10,SHOVALN                                                TPR01600
          LA    R10,TPDCB                                                  TPR01610
          USING IHADCB,R10                                                 TPR01620
          TM    DCBOFLGS,X'10' HAS DCB BEEN OPENED?                        TPR01630
```

```
         BO     OOKK          YES                                          TPR01640
         TM     BADBOMB,X'AA'  HAS THERE BEEN PREVIOUS CATASTROPHE?        TPR01650
         BNO    ONWITHIT       NOPE, GO AND OPEN IT                       TPR01660
         SPACE 2                                                           TPR01670
KIKIT    ABEND 3,DUMP          SHOULDNT EVER GET HERE, CRASH              TPR01680
         SPACE 2                                                           TPR01690
ONWITHIT OPEN  (TPDCB,INPUT)                                               TPR01700
         TM     DCBOFLGS,X'10' DID STUPID THING OBEY?                      TPR01710
         BNO    KIKIT           NOPE, GO PUNT                              TPR01720
         L      R9,DCBDEBAD    GET POINTER AND DEVICE STATISTICS TABLE     TPR01730
         L      R9,32(R9)       GET UCB ADDR OUT OF DEB                    TPR01740
         SR     R6,R6                                                      TPR01750
         IC     R6,9(R9)       GET STAT TABLE POINTER                      TPR01760
         MH     R6,=H'10'      POINTER * 10                                TPR01770
         L      R9,16          POINTER TO CVT                              TPR01780
         L      R9,112(R9)     POINTER TO STAT TABLE START                 TPR01790
         LA     R9,0(R6,R9)     GOTCHA STAT TABLE                          TPR01800
         ST     R9,STATTAB     SAVE ADDRESS OF STAT TABLE                  TPR01810
         MVC    OLDSTAT,0(R9)   SAVE ITS INFO                              TPR01820
         SPACE 2                                                           TPR01830
OOKK     L      R0,SHOVALN  GET BLKSIZE FOR TAPE EXCP BUFFER               TPR01840
         STH    R0,BYTCNT      PUT DATA LENGTH INTO CCW                    TPR01850
         L      R1,SHOVAAD                                                 TPR01860
         ST     R1,TPBUFLOC                                                TPR01870
         MVC    TPBLOC,TPBUFLOC+1  PUT BUFFER LOC IN CCW                   TPR01880
         LTR    R0,R0                                                      TPR01890
         BP     OOKKK                                                      TPR01900
         MVI    TPCCW,X'37'                                                TPR01910
         BAL    R9,TPGET                                                   TPR01920
         MVI    TPCCW,X'02'                                                TPR01930
         BAL    R9,TPWAIT                                                  TPR01940
         B      RETURN                                                     TPR01950
         SPACE 2                                                           TPR01960
         SPACE 2                                                           TPR01970
OOKKK    BAL    R9,TPGET       GO READ A BUFFER                            TPR01980
         SPACE 2                                                           TPR01990
         BAL   R9,TPWAIT       GO WAIT TILL READ FINISHED                  TPR02000
RETURN   LA     R15,0          NORMAL RETURN, MODIFIED ELSEWHERE           TPR02010
         L      R13,4(R13)     RESTORE REGISTERS                           TPR02020
         L      R14,12(R13)                                                TPR02030
         LM     R0,R12,20(R13)                                             TPR02040
         BR     R14            ALL RETURNS THRU HERE                       TPR02050
         SPACE 2                                                           TPR02060
TPEOF    MVI    RETURN+3,X'04'  SET EOF RETURN                             TPR02070
         SPACE 2                                                           TPR02080
OUT      CLOSE TPDCB                                                       TPR02090
         SPACE 2                                                           TPR02100
         MVI    BADBOMB,X'AA'  TURN ON FLAG                                TPR02110
```

```
         B      RETURN                                                  TPR02120
         SPACE  2                                                       TPR02130
GETSTAT  L      R9,STATTAB      ARRIVE HERE ON BAD READ                 TPR02140
         MVC    NEWSTAT,0(R9)    GET CURRENT STAT TABLE                 TPR02150
         L      R9,SHOVAAD      MOVE OLD AND NEW STAT TABLES TO FTN     TPR02160
         MVC    0(16,R9),OLDSTAT   ARRAY BEFORE ERROR RETURN           TPR02170
         MVI    RETURN+3,X'08'   SET I/O ERROR RETURN                  TPR02180
         B      OUT                                                     TPR02190
         SPACE  2                                                       TPR02200
TPGET    MVI    TPECB,X'00'     CLEAR ECB                               TPR02210
         MVC    TPEXCP,TPCCW                                            TPR02220
         MVI    RDFLG,X'FF'     TURN ON READ FLAG                       TPR02230
         EXCP   IPIOB           DO IT                                   TPR02240
         BR     R9              RETURN                                  TPR02250
         SPACE  2                                                       TPR02260
TPWAIT   TM     TPECB,X'40'     IS IT ALREADY DONE?                     TPR02270
         BO     NOWAIT          YES                                     TPR02280
         WAIT   ECB=TPECB       NO,WAIT FOR IT                          TPR02290
NOWAIT   CLI    TPECB,X'7F'     DID IT DO IT OK?                        TPR02300
         BE     OK1             YES,CONTINUE                            TPR02310
         SPACE  2                                                       TPR02320
         CLI    TPCSW+3,X'0D'  PROBABLE EOF IF CHAN-DEV END & UNIT EXCPT TPR02330
         BNE    GETSTAT        NOPE, GO FIND ERROR                     TPR02340
         CLI    FLAGS1,X'04'    EXCEPTIONAL CONDIT BIT ON? (=EOF)       TPR02350
         BNE    GETSTAT        NO EOF                                  TPR02360
         L      R1,DCBBLKCT     DECREMENT  DCBBLKCT SO IT MATCHES TAPE  TPR02370
         BCTR   R1,0                TRAILER LABELS                      TPR02380
         ST     R1,DCBBLKCT                                             TPR02390
         EOV    TPDCB          YES,EOF - FORCE CONTROL TO EODAD RTN    TPR02400
         SPACE  2                                                       TPR02410
OK1      BR     R9               RETURN                                 TPR02420
         SPACE  2                                                       TPR02430
SAV1     DC     18F'0'                                                  TPR02440
         SPACE  2                                                       TPR02450
OLDSTAT  DC     D'0'            COPY OF STAT TABLE AFTER OPEN           TPR02460
NEWSTAT  DC     D'0'            COPY OF STAT TABLE UPON ERROR           TPR02470
         SPACE  2                                                       TPR02480
TPEXCP   DC     D'0'           LOC CONTAINING CCW BEING USED            TPR02490
TPCCW    DC     X'02'           READ                                    TPR02500
TPBLOC   DC     AL3(0)          DATA ADDRESS                            TPR02510
FLGS     DC     X'20'           SUPPRESS INCORRECT LNGT                 TPR02520
BYTCNT   DC     H'0'            BYTE COUNT                              TPR02530
         SPACE  2                                                       TPR02540
SHOVSMF  DC     A(0)            LOC OF SMF INFO                         TPR02550
SHOVAAD  DC     A(0)            ADDR OF FORTRAN ARRAY                   TPR02560
SHOVALN  DC     F'0'            BYTE LENGTH OF FORTRAN ARRAY            TPR02570
         SPACE  2                                                       TPR02580
TPBUFLOC DC     A(0)            LOC OF DCBBLKSI LENGTH TAPE BUFFER      TPR02590
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          SPACE 2                                                          TPR02600
STATTAB   DC    A(0)            LOC OF STAT TABLE                          TPR02610
          SPACE 2                                                          TPR02620
          SPACE 2                                                          TPR02630
RDFLG     DC    X'00'            =X'FF' AFTER READ, BEFORE WAIT            TPR02640
BADBOMB   DC    X'00'           FLAG TO TELL WHETHER DCB USED BEFORE       TPR02650
          SPACE 2                                                          TPR02660
TPDCB     DCB   DDNAME=METTAP,MACRF=(E),EODAD=TPEOF,DSORG=PS,             *TPR02670
                IOBAD=TPIOB,DEVD=TA                                        TPR02680
          SPACE 2                                                          TPR02690
          DS    0F                                                         TPR02700
TPIOB     DS    0CL32                                                      TPR02710
FLAGS1    DC    X'00'                                                      TPR02720
FALGS2    DC    X'00'                                                      TPR02730
SENSE1    DC    X'00'                                                      TPR02740
SENS2     DC    X'00'                                                      TPR02750
ECBCOD    DC    X'00'                                                      TPR02760
ECBADD    DC    AL3(TPECB)                                                 TPR02770
FALGS3    DC    X'00'                                                      TPR02780
TPCSW     DC    7X'00'                                                     TPR02790
SIOCODE   DC    X'00'                                                      TPR02800
EXCPADD   DC    AL3(TPEXCP)                                                TPR02810
RESERC    DC    X'00'                                                      TPR02820
DCBADDR   DC    AL3(TPDCB)                                                 TPR02830
REPOMOD   DC    X'00'                                                      TPR02840
RESTADR   DC    AL3(0)                                                     TPR02850
BLCINC    DC    H'1'                                                       TPR02860
ERORCNT   DC    H'0'                                                       TPR02870
          SPACE 2                                                          TPR02880
TPECB     DC    F'0'                                                       TPR02890
          SPACE 2                                                          TPR02900
ARGS      DSECT                                                            TPR02910
AADD      DC    A(0)            ADDRESS OF FORTRAN ARRAY                   TPR02920
ALADD     DC    A(0)            ADDRESS OF LENGTH OF FORTRAN ARRAY         TPR02930
          SPACE 2                                                          TPR02940
          PRINT NOGEN                                                      TPR02950
          DCBD  DSORG=PS,DEVD=TA                                           TPR02960
          PRINT GEN                                                        TPR02970
          SPACE 2                                                          TPR02980
TPRD      CSECT                                                            TPR02990
          LTORG                                                            TPR03000
          END                                                              TPR03010
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A P P E N D I X C

```
C TITLE           HYDRO - A MODIFIED VERSION

C PROGRAMMER      R.E.GREER MODIFIED AN ORIGINAL PROGRAM,HYDRO, DEVELOPED
C                 BY THE U.S. NAVAL POSTGRADUATE SCHOOL, DEPARTMENT OF
C                 OCEANOGRAPHY.

C PURPOSE         THE PROGRAM READS AND INTERPOLATES TEMPERATURE AND
C                 SALINITY DATA FOR 'STANDARD DEPTHS' AND CALCULATES
C                 SIGMA-T, SPECIFIC VOLUME ANOMALY, SOUND VELOCITY,
C                 DYNAMIC HEIGHT, DYNAMIC HEIGHT ANOMALY, AND GEOSTROPHIC
C                 CURRENTS AND TRANSPORT.

C MODIFICATIONS   THE ORIGINAL PROGRAM HYDRO HAS BEEN MODIFIED TO
C                 INCLUDE AN INCREASED CAPABILITY TO PROCESS TEMPERATURE
C                 AND SALINITY DATA ON A VERTICAL DEPTH SCALE INTERVAL AS
C                 FINE AS 2.5 METERS,AND A CARD PUNCHING ROUTINE WHICH
C                 PRODUCES COMPOSITE DATA CARDS, EACH CONTAINING DEPTH,
C                 TEMPERATURE, SALINITY, GEOSTROPHIC VELOCITY, DYNAMIC
C                 HEIGHTS, AND MASS TRANSPORT. MODIFICATIONS AFFECT ONLY
C                 THE MAIN PROGRAM AND SUBROUTINE GEOCUR.

C DATE            26 JUNE 1975
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      REAL *8 ITL(12),INFO(200,4)
      DIMENSION ID(200),IT(200),IS(200),IO(200)
      DIMENSION D(200),T(200),S(200),O2(200),SNDV(98)
      DIMENSION SD(98),ST(98),SS(98),SGT(98),SV(98),SVA(98)
      DIMENSION SGP(200),DH(98),BDH(98),DD(98),SLEV(48),BSVA(98)
      DIMENSION NPA(48),NPB(48),NO(48),NSTA(48,3),ALT(48),ALM(48)
      DIMENSION ALN(48),ANM(48),IDATE(48,3),DHT(48,98),ADH(98)
      COMMON /INFO/ ASS(2000),ASGT(2000),AST(2000),KB
    8 FORMAT (1H1,'STATION ',3A4,' LATITUDE ',I2,F5.1,'N LONGITUDE ',
     1I3,F5.1,'W  DATE ',3A4/5X,' TO ',3A4,' LATITUDE ',I2,F5.1,
     2'N LONGITUDE ',I3,F5.1,'W  DATE ',3A4//)
    9 FORMAT (8(1X,2I2,F5.0))
   10 FORMAT (1H1,'STATION ',3A4,' LATITUDE =',I2,F5.1,'N LONGITUDE =',
     1I4,F5.1,'W  DATE ',3A4//)
   11 FORMAT (10X,'* INDICATES ADJUSTED VALUE')
   12 FORMAT (10X,'? INDICATES QUESTIONABLE VALUE')
   99 FORMAT (10X,'X INDICATES NO VALUE')
   13 FORMAT (I4,3A4,F4.0,F4.1,F4.0,F5.1,3A4)
   15 FORMAT (F8.1,A1,1X,F9.2,A1,F10.3,A1,F9.3,A1,7X;4A8)
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```
   16 FORMAT (10X,'DEPTH  TEMPERATURE  SALINITY  SIGMA-T  OXYGEN'//)
   17 FORMAT (20X,'OBSERVED VALUES'//)
   18 FORMAT (//20X,'INTERPOLATED VALUES'//)
   19 FORMAT (10X,'DEPTH  TEMPERATURE  SALINITY  SIGMA-T   SND VEL   SPE
     1C VOL  SPEC V ANOM  MEAN SVA   DELTA D  DYNAMIC HEIGHT'//)
   20 FORMAT(10X,F5.0,F10.2,F12.3,F9.3,F12.2,F10.4,F12.6,25X,F10.5/80X,
     12F12.6)
   21 FORMAT (10X,F6.1,A1,F8.2,A1,F11.3,A1,F8.3,F9.3,A1,4X,4A8/)
      DATA SD/0.,5.,10.,15.,20.,25.,30.,35.,40.,45.,50.,55.,60.,65.,70.,
     175.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,135.,140.,
     2145.,150.,155.,160.,165.,170.,175.,180.,185.,190.,195.,200.,205.,
     3210.,215.,220.,225.,230.,235.,240.,245.,250.,255.,260.,265.,270.,
     4275.,280.,285.,290.,295.,300.,310.,320.,330.,340.,350.,375.,400.,
     5425.,450.,475.,500.,525.,550.,575.,600.,625.,650.,675.,700.,725.,
     6750.,775.,800.,825.,850.,900.,1000.,1100.,1200.,1300.,1500.,1700.,
     72000.,2500.,3000.,4000.,5000./
C
C          READ THE NUMBER OF GEOSTROPHIC CURRENTS & TRANSPORTS
C          TO BE CALCULATED
C
      READ (5,13) NGC
      IF(NGC.EQ.0) GO TO 410
      READ (5,9) (NPA(I),NPB(I),SLEV(I),I=1,NGC)
  410 NPA(NGC+1)=0
      M=1
      KB=1
  999 FORMAT(1X,'  KB = ',I8,///)
      WRITE(6,999) KB
      DO 41 L=1,48
C
C          READ HEADING CARD, CHECK FOR  END OF DATA, THEN
C          READ NOV DATA CARDS.
C
      READ (5,13) NOV,(NSTA(L,K),K=1,3),ALT(L),ALM(L),ALN(L),ANM(L),
     1(IDATE(L,K),K=1,3)
      IF (NOV) 32,32,24
   24 DO 25 I=1,NOV
      READ (5,15) D(I),ID(I),T(I),IT(I),S(I),IS(I),O2(I),IO(I),
     1(INFO(I,J),J=1,4)
C
C          SGTSVA IS SUBROUTINE TO COMPUTE SIGMA-T, SPECIFIC VOLUME
C          AND SPECIFIC VOLUME ANOMALY.
C
   25 CALL SGTSVA (T(I),S(I),D(I),SGP(I),SVNO,SVNO)
C
C          LGTP IS SUBROUTINE TO COMPUTE INTERPOLATED VALUES
C
      CALL LGTP(NOV,D,T,SD,ST,NA)
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```
      CALL LGTP(NOV,D,S,SD,SS,NB)
      NO(L)=NA
      DO 27 I=1,NA
C
CCC       SNDVEL IS SUBROUTINE TO COMPUTE SOUND VELOCITY
C
      CALL SNDVEL (ST(I),SS(I),SD(I),SNDV(I))
      CALL SGTSVA (ST(I),SS(I),SD(I),SGT(I),SV(I),SVA(I))
   27 CONTINUE
      NLT=ALT(L)
      NLN=ALN(L)
      WRITE (6,10) (NSTA(L,K),K=1,3),NLT,ALM(L),NLN,ANM(L),
     1(IDATE(L,K),K=1,3)
      WRITE (6,18)
      WRITE(6,19)
      NA=NA-1
      DH(1)=0.
      DO 30 I=1,NA
      BSVA(I)=(SVA(I)+SVA(I+1))*.5
      DD(I)=BSVA(I)*(SD(I+1)-SD(I))
   30 DH(I+1)=DH(I)+DD(I)
      DO 31 I=1,NA
      DHT(L,I)=DH(I)
      ASS(M)=SS(I)
      ASGT(M)=SGT(I)
      AST(M)=ST(I)
      M=M+1
   31 WRITE (6,20) SD(I),ST(I),SS(I),SGT(I),SNDV(I),SV(I),SVA(I),DH(I),
     1BSVA(I),DD(I)
      I=NA+1
      DHT(L,I)=DH(I)
      ASS(M)=SS(I)
      ASGT(M)=SGT(I)
      AST(M)=ST(I)
      M=M+1
      WRITE (6,20) SD(I),ST(I),SS(I),SGT(I),SNDV(I),SV(I),SVA(I),DH(I)
    3 FORMAT(1X,'  M = ',I4,///)
      WRITE(6,3) M
   41 CONTINUE
      IF(NGC.EQ.0) GO TO 33
   32 DO 42 L=1,48
      IF (NPA(L).EQ.0) GO TO 33
      BASE=SLEV(L)
      N1=NPA(L)
      N2=NPB(L)
      NU1=NO(N1)
      NU2=NO(N2)
      DO 43 I=1,NU1
```

```
   43 ADH(I)=DHT(N1,I)
      DO 44 I=1,NU2
   44 BDH(I)=DHT(N2,I)
      NLT=ALT(N1)
      NLN=ALN(N1)
      MLT=ALT(N2)
      MLN=ALN(N2)
  130 FORMAT(1X,3A4,I4)
      ISAVE=(NU1/2.0)+1.0
      IF(ISAVE.EQ.37) GO TO 131
      ISAVE=37
  131 WRITE(6,130) (NSTA(N1,K),K=1,3),ISAVE
      WRITE(7,130) (NSTA(N1,K),K=1,3),ISAVE
      WRITE (6,8) (NSTA(N1,K),K=1,3),NLT,ALM(N1),NLN,ANM(N1),
     1(IDATE(N1,K),K=1,3),(NSTA(N2,K),K=1,3),MLT,ALM(N2),MLN,
     2ANM(N2),(IDATE(N2,K),K=1,3)
      ALAT=ALT(N1)+ALM(N1)/60.
      ALON=ALN(N1)+ANM(N1)/60.
      BLAT=ALT(N2)+ALM(N2)/60.
      BLON=ALN(N2)+ANM(N2)/60.
C
CCC       DSTSTA IS SUBROUTINE TO COMPUTE DISTANCE BETWEEN STATIONS
C
      CALL DSTSTA (ALAT,ALON,BLAT,BLON,X2,DIST)
C
CCCC      GEOCUR IS SUBROUTINE TO COMPUTE GEOSTROPHIC CURRENTS
CCC       AND TRANSPORTS
C
   42 CALL GEOCUR(NU1,ADH,NU2,BDH,SD,BASE,X2,NNN,DIST)
   33 STOP
      END
```

```
      SUBROUTINE GEOCUR(NA,ADH,NB,BDH,SD,BASE,X2,NNN,DIST)
      DIMENSION ADH(NA),BDH(NB),SD(98),RVEL(98),VEL(98),AMB(98),AVT(98)
      COMMON /INFO/ ASS(2000),ASGT(2000),AST(2000),KB
   10 FORMAT (13X,'DEPTH    DYN HT    DYN HT    DIFF HT   REL VEL   ABS
     1VEL    ABS VOL'/14X,' M.      STA A     STA B      A-B       CM/SEC
     2    CM/SEC   TRANSPORT *'/)
   11 FORMAT(13X,F5.0,2X,3(F9.5,1X),2(F8.2,2X)/72X,F9.5)
   12 FORMAT ('***** LEVEL OF NO MOTION MUST BE EQUAL TO A STANDARD DEPT
     1H *****')
   14 FORMAT(' ',10X,'TOTAL VOLUME TRANSPORT IS COMPUTED BY SUMMING INCR
     1EMENTAL TRANSPORTS ABOVE LEVEL OF NO MOTION:'//5X,'TOTAL TRANSPORT
     2 PERPENDICULAR TO THE PLANE OF THE STATIONS IS ',F7.3,' SVERDRUPS
     3RELATIVE TO ',F5.0,' METERS')
   15 FORMAT(//'  * VALUES IN THIS COLUMN REPRESENT TRANSPORTS IN LAYER
     1INCREMENTS'//)
      IF(NA.LE.NB) GO TO 51
      N=NB
      GO TO 52
   51 N=NA
   52 DO 53 I=1,N
      AMB(I)=ADH(I)-BDH(I)
   53 RVEL(I)=-AMB(I)*X2
      DO 54 I=1,98
      IF(BASE.EQ.SD(I))GO TO 55
   54 CONTINUE
      WRITE (6,12)
      GO TO 70
   55 NM=I
      IF(NM.GT.N) NM=N
      BASE=SD(NM)
      DO 56 I=1,N
   56 VEL(I)=RVEL(I)-RVEL(NM)
      DO 553 I=2,N
      J=I-1
      AVEL=(VEL(I)+VEL(J))*0.005
  553 AVT(J)=AVEL*DIST*(SD(I)-SD(J))*1.0E-03
      NM=NM-1
      VT=0.
      DO 57 I=1,NM
   57 VT=VT+AVT(I)
C
C  IF STATION A IS TO THE RIGHT OF STATION B AS AN OBSERVER LOOKS AT
C  THE PLANE OF THE STATIONS, A POSITIVE CURRENT FLOWS AWAY FROM THE
C  OBSERVER.
C
   58 WRITE (6,10)
      N=N-1
      DO 60 I=1,N
```

```
 60 WRITE (6,11) SD(I),ADH(I),BDH(I),AMB(I),RVEL(I),VEL(I),AVT(I)
    N=N+1
    I=N
    WRITE (6,11) SD(I),ADH(I),BDH(I),AMB(I),RVEL(I),VEL(I)
    NNN=N
    WRITE(6,15)
    WRITE(6,14)VT,BASE
100 FORMAT(1X,F4.0,2F8.3,F9.2,F7.0,2F5.0,F7.2,F8.2,F10.5,2I4)
110 FORMAT(1X,'SD',5X,'SS',6X,'SGT',6X,'VEL',5X,'VEL',3X,'ADH',2X,
   1'BDH',3X,'ST',5X,'RVEL',5X,'AVT',4X,'J',3X,'K',//)
120 FORMAT('1')
125 FORMAT('0')
130 FORMAT(1X,F4.0,2F8.3,F9.2,F7.0,2F5.0,F7.2,F8.2,10X,2I4)
    WRITE(6,120)
    WRITE(6,125)
    WRITE(6,110)
    K=1
  5 FORMAT(1X,'  KB = ',I4,///)
    WRITE(6,5) KB
 45 DO 50 J=1,N,2
    ADH(J)=(ADH(N)-ADH(J))*100
    BDH(J)=(BDH(N)-BDH(J))*100
    WRITE(6,100) SD(J),ASS(KB),ASGT(KB),VEL(J),VEL(J),ADH(J),BDH(J),
   1AST(KB),RVEL(J),AVT(J),J,K
    WRITE(7,100) SD(J),ASS(KB),ASGT(KB),VEL(J),VEL(J),ADH(J),BDH(J),
   1AST(KB),RVEL(J),AVT(J),J,K
    K=K+1
    JSCAR=J
    KB=KB+2
 50 CONTINUE
    J=JSCAR+1
    KB=KB-1
    ADH(N)=0.0
    BDH(N)=0.0
    WRITE(6,130) SD(N),ASS(KB),ASGT(KB),VEL(N),VEL(N),ADH(N),BDH(N),
   1AST(KB),RVEL(N),J,K
    WRITE(7,130) SD(N),ASS(KB),ASGT(KB),VEL(N),VEL(N),ADH(N),BDH(N),
   1AST(KB),RVEL(N),J,K
    KB=KB+1
 70 RETURN
    END
```

```
      SUBROUTINE DSTSTA(SATI,ONGI,SATII,ONGII,X2,DIST)
      IMPLICIT REAL*4 (K)
      REAL*8 A,E
      DATA A/111132.09/,B/566.05/,C/1.20/,D/.002/
      DATA E/111415.13/,F/94.55/,G/.012/
   10 FORMAT (10X,'MEAN LATITUDE = ',F6.2/15X,'DISTANCE = ',F6.2,
     1' KILOMETERS'/)
      CON=2*3.1416/360
      AATI=SATI*CON
      AATII=SATII*CON
      $MERI=A-B*COS(2*AATI)+C*COS(4*AATI)-D*COS(6*AATI)
      PARI=E*COS(AATI)-F*COS(3*AATI)+G*COS(5*AATI)
      $MERII=A-B*COS(2*AATII)+C*COS(4*AATII)-D*COS(6*AATII)
      PARII=E*COS(AATII)-F*COS(3*AATII)+G*COS(5*AATII)
      ALLAT=($MERI+$MERII)/2
      ALLON=(PARI+PARII)/2
      DLAT=SATI-SATII
      DLON=ONGI-ONGII
      KLAT=DLAT*ALLAT/1000
      KLONG=DLON*ALLON/1000
      KDIX=SQRT(KLAT**2+KLONG**2)
      DIST=KDIX
      W2=1.458E-4
      PSI=(SATI+SATII)*0.5
      PSJ=(2.*3.14159/360.)*PSI
      SPSI=SIN(PSJ)
      IF(SPSI.LT.0.1) SPSI=0.1
      X2=1./(W2*SPSI*KDIX)
      WRITE(6,10) PSI,KDIX
      RETURN
      END
```

```
      SUBROUTINE LGTP(N,D,V,SD,CV,NN)
      DIMENSION D(N),V(N),CV(98),SD(98)
111   DO 188 J=1,98
112   DO 186 I=1,N
      IF(SD(J)-D(N))113,115,190
115   CV(J)=V(N)
      GO TO 191
113   IF(SD(J)-D(I))114,114,116
114   CV(J)=V(I)
      GO TO 188
116   IF(SD(J)-D(I+1))120,118,186
118   CV(J)=V(I+1)
      GO TO 188
120   IF(I-1)132,132,126
126   XA=(SD(J)-D(I))*(SD(J)-D(I+1))*V(I-1)/
     1((D(I-1)-D(I))*(D(I-1)-D(I+1)))
      XB=(SD(J)-D(I-1))*(SD(J)-D(I+1))*V(I)/
     1((D(I)-D(I-1))*(D(I)-D(I+1)))
      XC=(SD(J)-D(I-1))*(SD(J)-D(I))*V(I+1)/
     1((D(I+1)-D(I-1))*(D(I+1)-D(I)))
      ANSU=XA+XB+XC
132   IF ((I+2)-N)133,133,134
133   YA=(SD(J)-D(I+1))*(SD(J)-D(I+2))*V(I)/
     1((D(I)-D(I+1))*(D(I)-D(I+2)))
      YB=(SD(J)-D(I))*(SD(J)-D(I+2))*V(I+1)/
     1((D(I+1)-D(I))*(D(I+1)-D(I+2)))
      YC=(SD(J)-D(I))*(SD(J)-D(I+1))*V(I+2)/
     1((D(I+2)-D(I))*(D(I+2)-D(I+1)))
      ANSD=YA+YB+YC
134   ZA=(SD(J)-D(I+1))*V(I)/(D(I)-D(I+1))
      ZB=(SD(J)-D(I))*V(I+1)/(D(I+1)-D(I))
      ANSL=ZA+ZB
      IF(I-1)136,136,138
136   CV(J)=(ANSD+ANSL)/2.
      DLL=(ANSD+ANSL+ANSL)/3.
      GO TO 188
138   IF((I+2)-N)140,140,142
140   CV(J)=(ANSU+ANSD+ANSL)/3.
      UD=(ANSU+ANSD)/2.
      GO TO 188
142   CV(J)=(ANSU+ANSL)/2.
      ULL=(ANSU+ANSL+ANSL)/3.
      GO TO 188
```

```
186 CONTINUE
188 CONTINUE
190 J=J-1
191 NN=J
    RETURN
    END
```

```
      SUBROUTINE SNDVEL (T,S,D,SVL)
      IF(D.LE.100.) GO TO 10
      IF(D.LE.200.) GO TO 20
      IF(D.LE.400.) GO TO 30
      IF(D.LE.700.) GO TO 40
      IF(D.LE.1500.)GO TO 50
      IF(D.LE.2000.)GO TO 60
      P=D*(.10318+(D-2000.)*2.6E-7)
      GO TO 5
   10 P=D*(.10245+D*3.0E-7)
      GO TO 5
   20 P=D*(.10248+(D-100.)*7.0E-7)
      GO TO 5
   30 P=D*(.10255+(D-200.)*6.0E-7)
      GO TO 5
   40 P=D*(.10267+(D-400.)*4.33E-7)
      GO TO 5
   50 P=D*(.10280+(D-700.)*3.0E-7)
      GO TO 5
   60 P=D*(.10304+(D-1500.)*2.7E-7)
    5 CONTINUE
      VT=T*(4.5721-T*(.044532-T*(2.6045E-4+T*(7.9851E-6))))
      VP=P*(.160272+P*(1.0268E-5+P*(3.5216E-9-P*(3.3603E-12))))
      VS=(S-35.)*(1.39799+(S-35.)*1.69202E-3)
      A1=T*(-.011244+3.1580E-8*P+T*(7.7711E-7+1.5790E-9*P))
      A2=P*(7.7016E-5-1.2943E-7*P)
      A3=P*T*(-1.8607E-4+T*(7.4812E-6+T*(4.5283E-8)))
      A4=P*P*(T*(-2.5294E-7+T*1.8563E-9)+P*T*(-1.9646E-10))
      SVL=1449.14+VT+VP+VS+(S-35.)*(A1+A2)+A3+A4
      RETURN
      END
```

```
      SUBROUTINE SGTSVA (T,S,D,SGT,SV,SVA)
      ST=-(((T-3.98)**2)/503.57)*((T+283.)/(T+67.26))
      CL=(S-.030)/1.805
      SO=-.069+1.4708*CL-.00157*CL**2+3.98E-5*CL**3
C
C          ALTERNATE METHOD OF COMPUTING SIGMA-ZERO:
C          SO=-0.093+0.8149*S-.000482*S**2+6.8E-6*S**3
C
      AT=T*(4.7867-.098185*T+.0010843*T**2)*1.E-3
      BT=T*(18.030-.8164*T+.01667*T**2)*1.E-6
      SGT=ST+(SO+.1324)*(1.-AT+BT*(SO-.1324))
      AFST=1./(1.+SGT*1.E-3)
      A=D*AFST*1.E-9
      B=4886./(1.+1.83E-5*D)
      C=227.+28.33*T-.551*T**2+.004*T**3
      E=D*1.E-4
      G=(SO-28.)/10.
      H=147.3-2.72*T+.04*T**2
      U=105.5+9.5*T-.158*T**2
      V=1.5*D**2*T*1.E-8
      W=32.4-.87*T+.02*T**2
      X=4.5-.1*T
      Y=1.8-.06*T
      SV=AFST-A*(B-C+E*U-V-G*(H-E*W)+G**2*(X-E*Y))
      AZ=.972643
      YA=-227.+.01055*D
      YB=.0126*(147.3-.00324*D)
      AP=AZ-D*AZ*(B+YA-YB)*1.E-9
      SVA=SV-AP
      RETURN
      END
```

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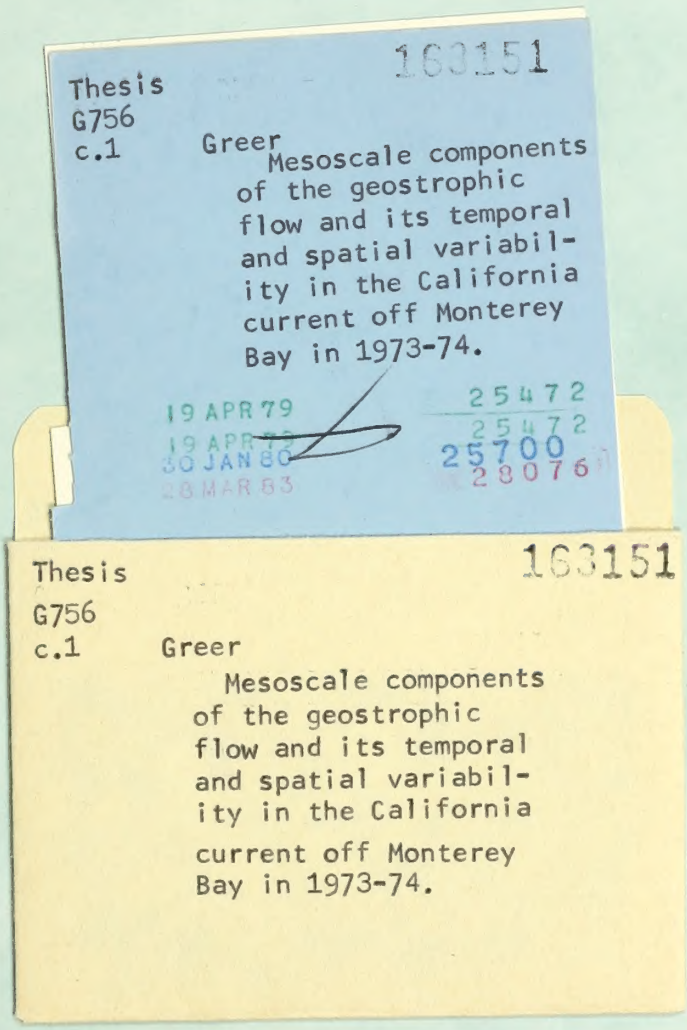
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